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A comparison of the legislative framework and policies in Taiwan's Four GHG reduction acts

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ABSTRACT

In order to respond to calls for newly industrialized countries to take greater responsibility for reducing GHG emission levels in the 2012 post-Kyoto treaty era, the Taiwan government has in recent years actively promoted related strategic policies and laws. In June 2009 the government passed the 'Renewable Energy Development Act' along with amendments to the 'Energy Administration Act', while at the same time developing drafts of the 'GHG Reduction Act' and 'Energy Tax Act'. This set of related policies and legislation, create a basic foundation for Taiwan's international GHG reduction responsibilities, institutional capacity and systems potential. This process of promoting GHG reduction touches on a wide range of issues including objective energy structure, GHG emission structure, the set of policies and laws, as well as the horizontal, vertical and socio-cultural pressures of the legislative process. Therefore, the main purpose of this paper is, through a comparison of the strategies adopted in each of the four GHG reduction acts, to trace the legislative background behind related acts and analyze the main aims, control models adopted and interaction going on between these four GHG reduction acts. Moreover with these four acts touching on the need for changes to be made to the energy structure, industrial structure and energy efficiency, as well as consumer behavior and other issues, the author also discusses the domestic and international economic factors and socio-cultural pressures affecting the legislative process. Finally, a comparison of energy consumption, GHG emission and industrial output, will reveal the direction which current efforts to implement changes to Taiwan's industrial policy, CO_2 reduction policy and legislation are moving.

Contents

1. Introduction 1724
2. Methodology and approach 1724
3. Energy framework structure and Taiwan greenhouse gas emissions 1725
   3.1. Energy supply and demand structure 1725
   3.2. Greenhouse gas emissions 1725
4. Analysis of the four GHG reduction acts 1726
   4.1. Developing policies and the four acts for reducing GHG emissions in Taiwan 1726
   4.2. Revisions to the Energy Management Act 1728
   4.3. Renewable Energy Development Act 1729
   4.4. Drafting the Energy Tax Act 1730
   4.5. Drafting of Greenhouse Gas (GHG) Reduction Act 1731
      4.5.1. Legislative structure 1731
      4.5.2. Reduction measures: registering, environmental impact assessments (EIA) and the commitment to voluntary reductions 1733
      4.5.3. The problem of CO_2 emission trade and CDM 1733
5. Comparison of the four carbon reduction acts 1734
   5.1. Legislative background and aims 1737
   5.2. Control model and main target for regulations 1737

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5.3. In practice: the harmony and interaction between the four acts 1738
5.3.1. Energy saving, energy efficiency and GHG efficiency standards 1738
5.3.2. Total emission controls 1738
5.3.3. Economic incentives, supplements and subsidies 1738
5.3.4. The establishing a fund and its use 1739
5.3.5. R&D incentives 1739
5.3.6. Limits to jurisdiction for central checks and balances 1739
5.3.7. New facilities, expansions or upgrading of equipment 1740
5.3.8. Access to data on emission levels 1740
6. The pressures and effectiveness of the 4 carbon reduction acts 1740
6.1. Implementing the policy before it is officially passed as law and its legal effectiveness 1740
6.2. Legislative pressure 1743
6.2.1. Vertical pressures on legislation 1743
6.3. The horizontal pressures on legislation 1744
6.4. Socio-cultural pressure 1745
6.5. Discussion 1746
7. Conclusion 1746
References 1747

1. Introduction

The severe threat of global climate change and the concept of greenhouse gas (GHG) emission reductions, having been incorporated into the Kyoto Protocol which came into effect on the 16th February 2005, has directly challenged countries' national competitiveness, as governments attempt to incorporate these new global regulations into national energy policies; working towards energy efficient policies, GHG emission reductions and a change in industrial policy. And since the main cause of GHG is the burning of fossilized fuels for electricity or industrial production uses [1,2], the challenge remains the greatest for the export-orientated, energy intensive newly industrialized countries. What is more, under the Kyoto Protocol, the United Nations Framework Convention on Climate Change Annex I countries agreed to reduce six types of GHG emissions to their 1990 levels and then reduce this level again by 5.6% between 2008 and 2012. Although under the accepted principle of common but different responsibilities, the burden of reduction targets in this first stage have been born, in the main, by the developed world. However in the next stage, developing countries and newly industrialized nations are expected to take an ever increasing responsibility for global reduction targets [3,4].

While Taiwan has been relatively proactive in comparison to other newly industrialized countries, yet the energy intensive nature of Taiwan's industrial structure, low energy efficiency and the tendency towards developing manufacturing industries in planning industrial policy means that Taiwan's energy consumption and GHG levels remain high. At the end of 2008 Taiwan's total GHG emission levels accounted for 1% of all emissions globally, the 22nd highest emitter of GHG globally. Moreover, CO_2 emissions per person in Taiwan were also found to be 18th highest in the world. Therefore Taiwan faces serious challenges in fulfilling the demands of international climate treaties for GHG reductions.

In recent years Taiwan's government has actively worked to revise its Electricity Act and Petroleum Management Act in order to strengthen the liberalization of the energy market and improve energy efficiency. In June of 2009 the government passed amendments to the Energy Management Act and Renewable Energy Development Act and began promoting new legislation such as the GHG Reduction Act and the Energy Tax Act. Such legislation shows that Taiwan's government is actively responding to international demands for reductions in GHG emissions. However, since these four acts on GHG reductions are inseparable, government policies and related laws need to be discussed and analyzed together in order to get an overall perspective of their impact on energy saving, energy efficiency, renewable energy, energy industries and industrial competitiveness.

The main aim of this study is to carry out a comprehensive analysis and comparison of the regulations and legislative benefits contained within these four Acts, along with the extent of their mutual compatibility and harmony, in terms of both policy considerations and legislative motivations. This analysis in turn will enable a discussion on the opportunities which exist under the current energy and industrial structure and the predicament of legislative and policy targets, finally making an assessment of the overall outlook and recommendations as to how to proceed.

2. Methodology and approach

At the end of 2009 the Global Framework Convention on Climate Change Conference (COP15) was held in Copenhagen. Although a concrete agreement was not reached, in the second stage of the Kyoto Protocol's CO_2 reduction targets, beginning in 2012, newly industrialized nations will sooner or later be given reduction targets for their GHG emissions [4–7]. These talks also touched on the calculation method used for setting NIC's allowances, international acknowledgements and providing technological and financial support to Annex II countries to support them in their reduction targets. At the same time, besides reducing the quantity of emissions, these countries can also develop qualitative mitigation commitments, including policies on sustainable development including CDM, renewable energy, energy efficiency and energy saving mechanisms. Therefore in the post-2012 climate regime South-North Dialogue will have three internationally acknowledged GHG reduction criteria: responsibility, capacity (including CO_2 emissions and GDP, CO_2/per capita comparison) and potential [8]. And these three criteria will be a key entry point in this paper's analysis.

Osofsky identified three models influencing countries' legislation on climate change and related issues: vertical pressure, horizontal pressure and socio-cultural pressure [9]. This paper will adopt these three models in its analysis of Taiwan's 4 GHG reduction Acts. The vertical pressure to legislate includes national governments being pressurized at an international, domestic or local level to reduce GHG emissions; and this in turn relates back to the pressure from international, state and local environmental activists and activism. Horizontal pressure to legislate refers to pressure coming from the interaction and check and balance occurring between the Administrative Agency and Judicial Agency; not only the interaction between agencies but also the extent of the government's environmental controls and the political economical pressure which this gives rise to. Socio-cultural pressure

Table 1
Energy supply (indigenous and imported).

	1993	1995	1997	1999	2001	2003	2005	2007	2008
Total amount 10^3 KLOE	69,156	80,196	88,575	97,443	109,103	122,265	136,957	147,243	142,475
Imported%	97.2%	97.7%	98.1%	98.2%	98.7%	98.9%	99.1%	99.3%	99.3%
Indigenous%	2.8%	2.3%	1.9%	1.8%	1.3%	1.1%	0.9%	0.7%	0.7%
Consumption	61,006	68,976	76,456	85,599	98,743	105,484	112,614	121,212	117,686

Data source: Ministry of Economic Affairs (2009) [10].

refers to the awareness of global climate change issues by civil society, civil movements and industrial lobby groups. This paper will use these three key analytical models to probe into the issues related to Taiwan's four GHG reduction Acts and related policy developments.

Based upon the concepts of responsibility, capacity and potential along with the three legislative pressure models introduced above, the third section of this paper will analyze Taiwan's energy structure and provide a breakdown on the composition of the country's GHG emissions. The fourth section will introduce the background to the four GHG reduction Acts and policy, while at the same time probing into the frame, structure and intention behind these four Acts. The fifth section will compare the legislative aims, control model and standard functions of these four Acts and point out the areas of harmony where the four Acts mutually compliment one another. Then in the sixth section we will analyze these Four Acts in terms of their effectiveness in changing the make-up of Taiwan's energy sources, industrial energy structure, and energy efficiency and consumer behavior; while at the same time probing into the domestic and international factors and social economic pressures which might affect the successful implementation of these four Acts. Finally, we will compare energy consumption, GHG emissions and industrial value ratio, examining adjustments made to Taiwan's industrial policy, carbon reduction and legal system. The eighth section will provide the conclusion.

The four acts to be analyzed are the Energy Management Act and Renewable Energy Development Act which have already been passed, as well as the GHG Reduction Act and Energy Tax Act which are currently making progress in the legislative process. This paper will not only analyze these four Acts, but also their policy measure implications, related energy industry developments, stakeholders, lobby groups and pressure. From the perspective of framework structure, the Energy Management Act and Renewable Energy Development Act concern issues of saving energy, energy efficiency, renewable energy and other policies related to the development of green energy industries (energy efficiency deeds, LED, renewable energy industries, green service industries, etc.). At the same time while promoting legislation such as the GHG Reduction Act and the Energy Tax Act, the government has also shown a concern for issues related to GHG reduction target standards, such as registering GHG emission levels, inventories, carbon trading, voluntary reductions, green tax system and industrial competition.

3. Energy framework structure and Taiwan greenhouse gas emissions

3.1. Energy supply and demand structure

According to the most recent statistical data released by Taiwan's Ministry of Economic Affairs, Taiwan's total energy consumption in 2008 reached $1{,}176{,}86 \times 10^3$ KLOE, while energy supplies reached $142{,}475 \times 10^3$ KLOE (Table 1). Taiwan is far from rich in natural resources and relies almost entirely on imported energy fuel. As the numbers show (Table 1) Taiwan's self produced energy accounted for only 247×10^3 KLOE in 2008, that is 0.7% of all energy supplied; $141{,}527 \times 10^3$ KLOE of energy was imported accounting for 99.3% of all energy supplied.

From analyzing the composition of Taiwan's energy supply we can see that it still remains highly dependent on imported traditional fossilized energy sources, with fossil fuels accounting for 91.29% of all energy imports in 2008. Of this crude oil and petroleum products accounted for 49.5%, while coal and coal products accounted for 32.4%. This high dependence on two forms of energy, the consumption of which gives rise to high CO_2 levels, runs counter to the international trend towards environmental protection and sustainable development.

3.2. Greenhouse gas emissions

Taiwan emitted 289.8 million tons of GHG in 2008; of the six types of GHG which Taiwan was responsible for emitting that year CO_2 accounted for the majority, making up 94.04% of total emissions. And it was Taiwan's energy sector which must take responsibility for a high proportion of these CO_2 emissions as Taiwan's natural resources are limited, with 77.9% of electricity coming from petroleum energy, of which 52% comes from coal generated energy which emits especially high levels of CO_2 [11] (Fig. 1).

Over the past twenty years, dependency on fossil fuel energy and the composition of GHG emissions has with the push for economic development, grown to be an increasingly serious issue. Fig. 2 shows the GHG emission trend of various sectors in the period from 1990 to 2008 and clearly shows that the GHG emissions from Taiwan's energy sector have increased by 135.00%, an average increase of 4.86% a year. However in 2008 this trend experienced a minor change as the emission level for 2008 was down on that of 2007 by 4.01%. During this time the industrial and manufacturing sector's GHG emissions have increased by 58.54%, an average increase of 2.59% per year, but again in 2008 this fell by 7.32% from its 2007 level. Over this same time period, the agricultural industry's emissions decreased by 19.90%, with an overall annual growth of −1.23%, but in 2008 emissions in this area saw a reduction of 6.21% [12] on its 2007 levels.

In terms of CO_2 emissions released through the burning of fossil fuels for energy, Taiwan emitted 109 million tons in 1990, a figure which had more than doubled by 2008 when emission rates reached 255 million tons. That is to say that CO_2 emission rates have over the past 18 years increased by 135%, with an average annual increase of 4.9%. However in 2008 as a result of the global financial tsunami and government pressure to promote energy saving and a reduction in CO_2 emissions, the figure in 2008 was 4% down from that in 2007 (refer to Fig. 3).

Through this sector by sector breakdown analysis of Taiwan's 2008 CO_2 emission levels from burning fossil fuels (not including electricity use) in Fig. 4, the energy sector can be clearly identified as the greatest perpetrator of CO_2 emissions; accounting for 66.23% of all CO_2 emissions, far more than the industrial and transport sectors where CO_2 emission rates account for 16.19% and 13.36% respectively. Therefore, if one wants to effectively control GHG emissions and achieve reduction targets, reducing the emission rates in the energy, industrial and transport sectors should be a priority.

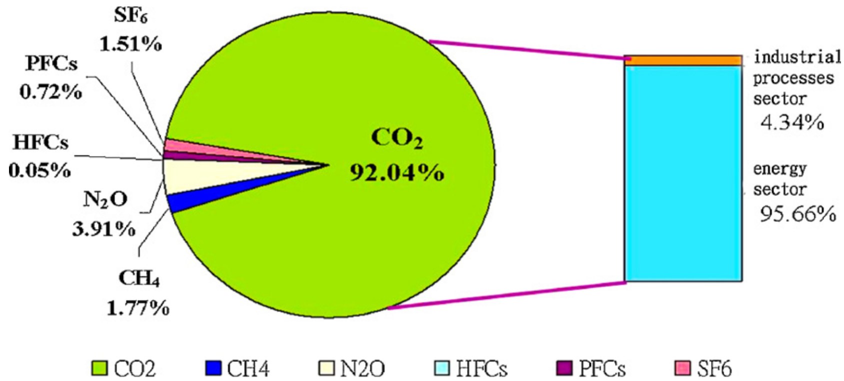


Fig. 1. Taiwan 2008 Greenhouse Gases Emission Status. *Data source*: Department of Environmental Protection Reduction Control Website [11].

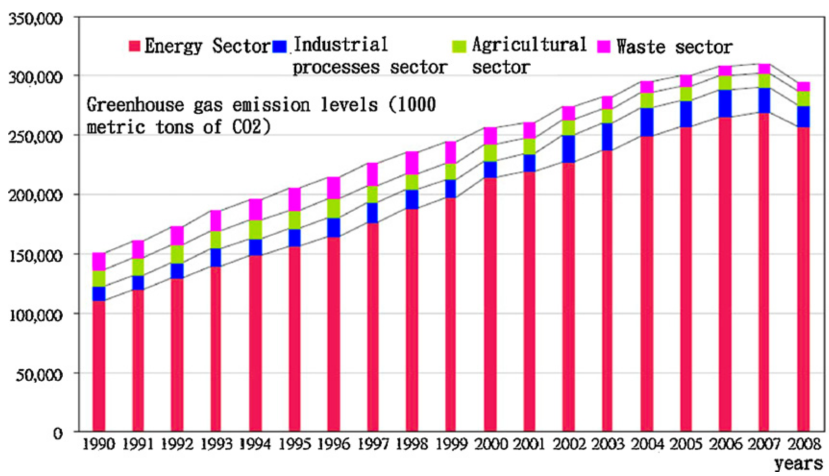


Fig. 2. Taiwan 1990–2008 Trend in Greenhouse Gas Emissions in different Sectors. *Data source*: Department of Environmental Protection Towards UNFCCC—Taiwan is willing to contribute global community' website [12].

4. Analysis of the four GHG reduction acts

4.1. Developing policies and the four acts for reducing GHG emissions in Taiwan

In response to the demands made in the 1997 'Kyoto Protocol' to reduce the emissions of six types of GHG, the Executive Yuan held its first 'National Energy Conference' in 1998 which was aimed at discussing five key related issues including the 'Trend towards a Framework Convention on Climate Change and Related Factors', 'Energy Policy and Structural Adjustments', 'Industrial Policy and Structural Adjustments', 'Energy Efficiency and Technological Developments' and 'Energy Policy Tools' [13]. At the same time, the Bureau of Energy under the Ministry of Economic Affairs compiled and edited the 'Energy Policy White Paper' which demanded that the electricity, industrial, transportation and residential sectors implement energy saving measures (a reduction of 16% in energy use by 2010) and promote targets for encouraging overall energy efficiency (1997–2010 annual increase of 1.2%). GHG reduction targets were also set with the aim of reducing CO_2 emission levels

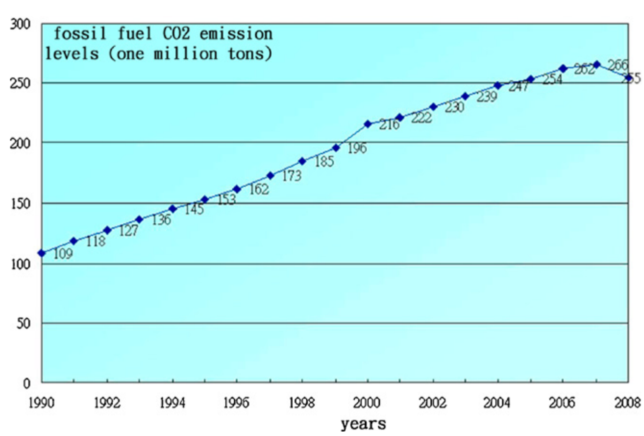


Fig. 3. Taiwan's 1990 to 2008 trend in CO_2 emissions from burning Fossil Fuels. *Data source*: Department of Environmental Protection Towards UNFCCC—Taiwan is willing to contribute global community' website [13].

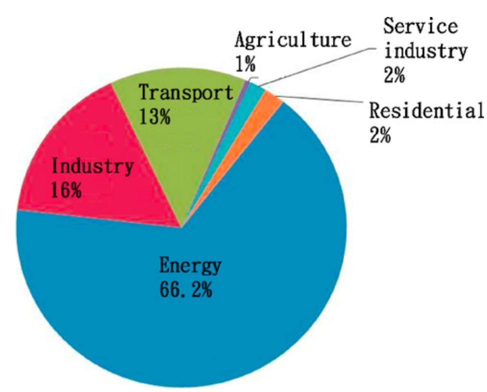


Fig. 4. Taiwan sector by sector fossil fuel burning CO_2 emission ratio. *Data source*: Department of Environmental Protection Towards UNFCCC—Taiwan is willing to contribute global community' website [12].

back to its 2000 standard level by the year 2020. At the same time in order to develop energy policy tools, it was recommended that research on industrial production and social costs be carried out on the effect of potential adjustments to energy costs such as oil and electricity prices or taxing systems for energy, as well as research on the prospects for levying carbon tax or other forms of energy tax. As for energy related laws and regulations, the government worked to plan revisions to the Electricity Industry Act and formulate the Petroleum Management Act in order to promote the liberalization of the energy industry and improvements in energy saving; while at the same time revising the GHG Emissions Control Act [14] and the Statute for Upgrading Industry in order to strengthen controls and encourage the use of energy saving equipment.

At the 2nd National Energy Conference held in 2005, the main focus was on how to respond to the Kyoto Protocol as GHG reduction mechanisms came into effect as well as other related issues[1] [15], in an attempt to directly respond to international pressure. This involved actively readjusting national energy policy and energy structures, improving energy efficiency and developing green energy sources, as well as planning CO_2 reduction targets for the industrial, transportation and residential sectors. And these plans also touched on the need for revisions and changes in related energy policy tools and legislation. First, targets set to improve energy efficiency by 2% per year, develop green energy transportation systems as well as Taiwan's LED industry, implement energy efficiency standard regulations as well as urban planning control mechanisms for promoting green architecture; moves which all involved making revisions to the Energy Management Act and these revisions received much attention during the conference. Second, it was recommended that more research be carried out into the development of green energy industries; including the promotion of renewable energy and new forms of energy (such as hydrogen energy or fuel cells) and the way these developments would affect the Renewable Energy Development Act legislation. Third, there were also a number of policies discussed which would need to be clearly set out in the GHG Reduction Act or would involve establishing an office for the Promotion of Greenhouse Reduction. These policies include setting CO_2 emission reduction targets for various sectors, demands for baseline surveys to be established on the energy consumption and CO_2 emissions of different sectors, the need to establish a mechanism for monitoring CO_2 reduction rates, as well as individual industries carrying out their own self-implemented reduction assessments, regulations for the overseeing and cross-examination of energy industry's GHG emissions and reduction rates, the development of efficiency standards for energy related equipment, regulations regarding commitments to CO_2 reductions in large scale investments and the implementation of cap and trade measures on GHG levels. In terms of CO_2 reduction targets, this conference reassessed the targets set in 1998 and the difficulties faced in reaching these targets and took the first steps in reassessing and formulating reduction targets. However, the conference failed to reach a consensus on this issue.[2]

In July 2006 the Executive Yuan held a conference on Taiwan's Economic Sustainable Development [16], the overall aim of promoting industrial competitiveness set the tone for internalizing external costs, constructing GHG control mechanisms, developing standard industrial effective techniques and strengthening technological applications to create a three win mechanism ensuring an environmentally, energy and industrial friendly policy. As part of this, in order to respond to the high oil prices facing energy policy, the need to push for a the passing of the Renewable Energy Development Act was identified with the aim of providing incentives for industries to pursue and develop green energy solutions and ensure greater diversity in energy sources. During the conference it was also acknowledged that there was a need to revise the Energy Management Act in order to promote energy saving and efficiency. While at the same time, in relation to GHG reduction targets, a consensus was reached that the government should promote the speedy completion of the GHG Reduction Act along with the Energy Tax Act and should also consider introducing carbon taxes, controls on overall GHG emissions and taxes on other forms of energy as policy tools which could work together to strengthen policy effectiveness. Similarly, related controls, reduction targets and the rights and responsibilities of a central competent authority are also important considerations for the GHG Reduction Act. In terms of the practical implementation of energy taxes, the need for comprehensive reforms of the tax system as a whole were discussed, including waiving parts of the traditional commodity tax, or reducing individual comprehensive tax. Moreover, before passing through the legislative process, priority should be given to enabling domestic energy prices to reflect production costs and abolish the subsidies and discounts traditionally offered to fossil fuel energy users.

At the Executive Yuan Monthly Meeting, on the 5th June 2008 the Sustainable Energy Policy Convention [17] was passed. This was an important milestone in promoting GHG reduction in Taiwan. The basic principle of this Convention is in the construction of a highly efficient, high priced, low emission, low dependence '2 high 2 low' energy consumption model and energy supply and demand system. This '2 high 2 low' model is aimed at increasing energy user and production efficiency, increasing energy user add-on price, pursuing a low carbon and low pollution energy supply and consumption method and finally to reduce dependence on fossil fuels and imported energy. In conclusion, the aim of this Convention is to promote a cross generation 3 win prospect between the currently competing areas of energy security, economic development and environmental protection. In order to achieve this aim, the Executive Yuan proposed constructing a complete set of CO_2 reduction legislation made up of four acts which could work as legal tools, including: the Greenhouse Gas Reduction Act (building GHG reduction capacity and ensuring substantial reductions in CO_2 emissions) and the Renewable Energy Development Act (developing clean energy); as well as discussing and formulating the Energy Tax Act (reflecting energy external costs) and revising the Energy Management Act (effectively promote energy saving measures). At the same time, this Convention also pushed for a concept of carbon neutrality to be at the center of policy planning in this area, in order to prevent, give advance warning and select clear principles by which to implement carbon management, cautiously assess the potential risks attached to using such forms of low carbon energy and formulating trace check mechanisms for various sectors. While in terms of coherent mechanisms, emphasizing open energy markets, promoting liberalization of energy markets, implementing carbon trade mechanisms and setting up a foundation for supporting efforts to reduce CO_2 emissions. As part of this, the Convention also set targets for Taiwan to maintain its CO_2 emission levels at the 2008 level between 2016 and 2020 and by 2025 to have reduced these levels back to the level of CO_2 emissions in 2000.

[1] In response to international pressure for reductions in greenhouse gas emissions the Conference focused on 6 main issues, including: 'Overall Strategy Direction', 'Energy Policy and Structural Development Direction', 'Green Energy Development and Provision of Energy Efficiency', 'Industrial Sector Response Strategy', 'Transportation Sector Response Strategy' and 'Residential and Commercial Sector Response Strategy' [15].

[2] 2005 National Energy Conference estimated that by 2010 CO_2 levels could be reduced by two million three hundred thousand tons, the basic level of emissions in 2000; by 2015 this could be reduced by seven million one hundred thousand tons, and by 2020 by 121 million tons, and by 2025 by 170 million tons. However these planned targets failed to gain consensus at the conference. The failure of participants in the most recent Energy Conference to set firm and concrete GHG CO_2 emission targets raised serious criticism from environmental groups.

Moreover, in accordance with the Convention, the Council for Economic Planning and Development announced their Energy Saving Carbon Reducing Action Plan [18] in September 2008. This plan takes further steps towards actively developing renewable energy, with the intention that electricity generated through renewable energy sources will account for more than 8% of the entire electric generation system by 2025. It also aims to encourage industries to voluntarily reduce greenhouse gases, develop a low carbon transportation network, low carbon cities and so on. While in terms of the legislative aspect, this plan emphasizes the need to develop and draft energy related laws, promote liberalization of the energy market, complete a search data bank on GHG, build an inventory on GHG emissions, promote international cooperation and finally to complete the legislation for the GHG Reduction Act in order to construct a strong legal foundation.

In April 2009 the 3rd National Energy Conference was held which upheld the concept of a low carbon society as its core. The main issues discussed included: (1) sustainable development and energy security; (2) energy technology and industrial development; (3) energy management and increased efficiency; (4) energy prices and open markets [19]. Other issues up for discussion were CO_2 reduction targets, decrease in energy concentration, new energy and energy saving carbon reducing technology, developing an overall technological development strategy and low consumption energy industry structure, as well as constructing laws (four GHG reduction acts and Sustainable Energy Basic Law), ensuring reasonable energy prices and liberalization of the energy market [20]. At the same time this Conference also reconfirmed the GHG reduction targets set out in the 2008 Sustainable Energy Policy Convention, emphasizing that Taiwan was willing to consider national reductions, adapt capacity, and honour mutual commitments to international treaties under the principle of different responsibilities. For Taiwan this involves setting the 2007 level of CO_2 emissions as a standard at 268 million tons, setting a target to keep CO_2 emissions at 2008 levels between 2016 and 2020, while by 2025 returning emission levels back to their 2000 level (214 million tons).

Another area which was focused on during the Conference was the revisions being made to the Energy Management Act, the Renewable Energy Development Act, the GHG Reduction Act and the Energy Tax Act along with the coopetition, interaction and crossover between these four acts and the extent of the harmony which currently exists between them. In particular with regards to the issue of a low energy consumption and low carbon industry structure, an aspect of the GHG Reduction Act, the Conference sought to emphasize that new and increasingly large scale investment in energy intensive industries should work quickly to complete the Strategic Environment Assessment (SEA) in order to reduce disputes over large scale investments in energy intensive industries. While the 'GHG Reduction Act' remains in the process of being passed, the government prior to 2010 should promote the Early Action, Offset Scheme and other voluntary reduction outcome verification mechanisms which increase the speed by which industries are able to carry out concrete action towards reducing CO_2 emissions.

The most recent development has been a response to the demands made in the Copenhagen Accord, a document drafted during the COP 15 in December 2009. The Accord requires that all Annex 1 countries set clear reduction targets for their 2020 CO2 emission levels before the 31st January 2010 and in response to this the Executive Yuan established the 'Energy Saving Carbon Reduction Promoting Meeting', with a whole hearted effort to encourage Taiwan in developing 'low carbon economy' and 'low carbon society', reflecting the international trend towards sustainable development [18]. As part of this in May 2010 a reexamination was made of the national energy saving carbon reduction targets, and new targets were set: in the next eight years energy efficiency should be improved by 2% a year, by 2015 the energy intensity index should be reduced by 20% of its 2005 level; R&D into related technology should be strengthened to reduce energy concentration by 50% by 2025. In terms of GHG reduction targets, having made reference to the Sustainable Energy Policy Convention and the standard year set by different countries, the government readjusted national CO_2 emission reduction targets, using the 2005 level as the standard target to be reached by 2020, while by 2025 the country should aim to return to its 2000 standard level. Legislation was also discussed and there was a push to strengthen the promotion of legislation for the GHG Reduction Act as well as the Sustainable Energy Basic Act.

4.2. Revisions to the Energy Management Act

In January 2002 amendments were made to the Energy Management Act in relation to GHG reductions, with the aim of strengthening the management of energy saving, providing jurisdiction for the competent authorities to carry out checks on energy saving user application documents, to incorporate regulations making it compulsory for cars and products with high energy consumption to be marked and energy consumption standards to be formulated. The most recent amendments to the Act, made in June 2009, were in accordance with the summary of the 2005 National Energy Conference. Within the framework of GHG reductions, a preventative early stage management model was adopted to monitor energy consumption, as well as categorize and increase efficiency of large scale energy users; for example establishing standards, tracking systems and controls to limit and inform energy users on the construction or expansion of facilities. Moreover, in order to improve energy efficiency and energy saving control measures, especially those enforcing regulations to ensure that energy intensive product manufacturers and imported products are obligated to clearly mark the product's energy efficiency level on the packaging. The Energy Management Act is made up of 30 articles and is separated into 4 chapters (Fig. 5) including: General (Sections 1–5.1), Standards for Energy Business and Providers (Sections 6–7), Standards for Energy Users and Checks (Sections 8–19.1) and Penalties (Sections 20–27).

In the first chapter, besides a new addition which stipulates that the Central Competent Authority should draw up a framework for energy development (Section 1), it also specifically states that an energy research development special fund should be established (Section 5), for the purpose of developing technology to exploit new forms of energy, replace current forms of energy and developing technology to improve energy efficiency. This fund could be financed by the electricity, oil refinery and oil import industries (Section 5.1). The second chapter not only regulates permission for energy supply enterprises (Section 6), but also stipulates the application documents needed, regulates the installation of energy storage equipment and safe storage limits (Section 7). It was the third chapter of the Energy Management Act which saw the most amendments when this Act was revised in June 2009. This was in order to strengthen energy saving and energy efficiency measures, as well as control the constructing of new facilities or expansions on already existing facilities. Moreover these amendments also simultaneously strengthened the jurisdiction of the central competent authority, including the regulating of energy users and efficiency (Section 8), setting up systems of check and balance for overseeing energy use (Section 9), standard cogeneration installation and purchasing methods for unused energy, rates and duties (Section 10), setting up of energy data application (Section 12), examining and verifying imports of installations or appliances which use energy (Section 14), verifying and indicating vehicle energy consumption levels and efficiency (Section 15), formulating plans for the exploiting of energy and standards for user assessment in accordance

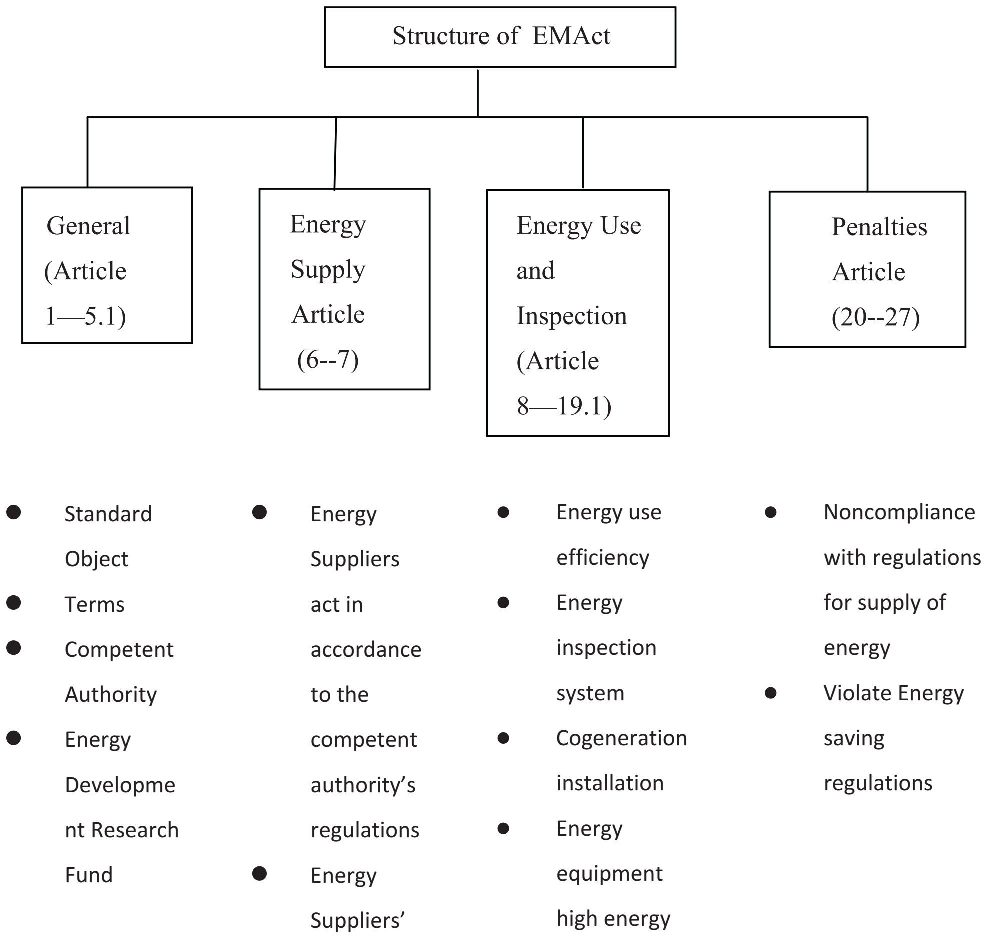


Fig. 5. Structure of the Energy Management (EM) Act. *Data source*: The author.

with the 'Energy Development Framework' (Section 15.1), examining and verifying energy user installations, new installations or expansions (Section 16), formulating energy saving standards for new architecture (Section 17), inspecting energy users, manufacturers, import plants and sellers (Section 19.1). Besides this, the amended version also distinguishes between different grades of energy user and the establishment of energy managers (Section 11), to strengthen capacity for reaching energy saving targets. The fourth chapter addresses penalties; stating that practitioners failing to comply with regulations and supply energy (Section 20), violate storage obligations (Section 22), violate energy saving regulations (Section 23), fail to gain approval for new installation or expansion of current energy installation (Section 25), or new buildings which violate energy saving standards (Section 26), will be fined and their energy supply suspended.

4.3. Renewable Energy Development Act

The Renewable Energy Development Act drawn up in June 2009 is an important legal foundation for Taiwan in making adjustments to its energy structure and development green energy industry. Providing financial incentives for renewable energy power generator installations with an installed capacity of at least 6.5 GW will not only improve Taiwan's green energy industry, making it more internationally competitive, but also change Taiwan's traditionally high dependence on power generated by fossil fuels; while simultaneously reducing the level of CO_2 emission. Constituting of 23 articles, this Act is separated into four chapters including General (Sections 1–5), Promotion, Incentives and Subsidies (Sections 6–13), Installation support and preferential policies for installations (Sections 14–17), Checks and penalties (Sections 18–22) (Fig. 6).

Chapter 1 aims to increase diversity of energy sources to achieve the legislative goal of sustainable national development (Section 1); stating the Ministry of Economic Affairs and Local Government as competent authorities (Section 2). Competent Authorities must ascertain the nature of renewable energy power generator installations for the purpose of subsidies and incentives (Section 4); electricity installations with a capacity of less than 500 kW, can avoid the standards set out in the 'Electricity Act' in terms of administrative controls for personal power generator installation users (Section 5). Chapter 2 deals with the incentives, subsidies and promoting of renewable energy, this second chapter is at the core of this legislation. It sets out targets and proportions for the future use of renewable energy. Article 6 stipulates that only renewable energy power generator installations with an installed capacity of between 6.5 and 100 GW are qualified to apply for installation subsidies (Section 6). Article 7 states that a renewable energy development fund should be established to subsidize renewable energy power prices, provide installation subsidies or subsidize specific models to promote its wider use (Section 7). Similarly to other countries promoting green energy, these subsidies are aimed at encouraging investment and development of renewable energy, in particular regulating power network grid and purchasing obligations (Section 8) as well as calculating methods for purchasing rates (Section 9) and subsidies for renewable energy power costs (Section 10). At the same time, this act also provides incentives for the first stages of developing renewable energy technology and model installations (Section 11), or those developing and exploiting solar

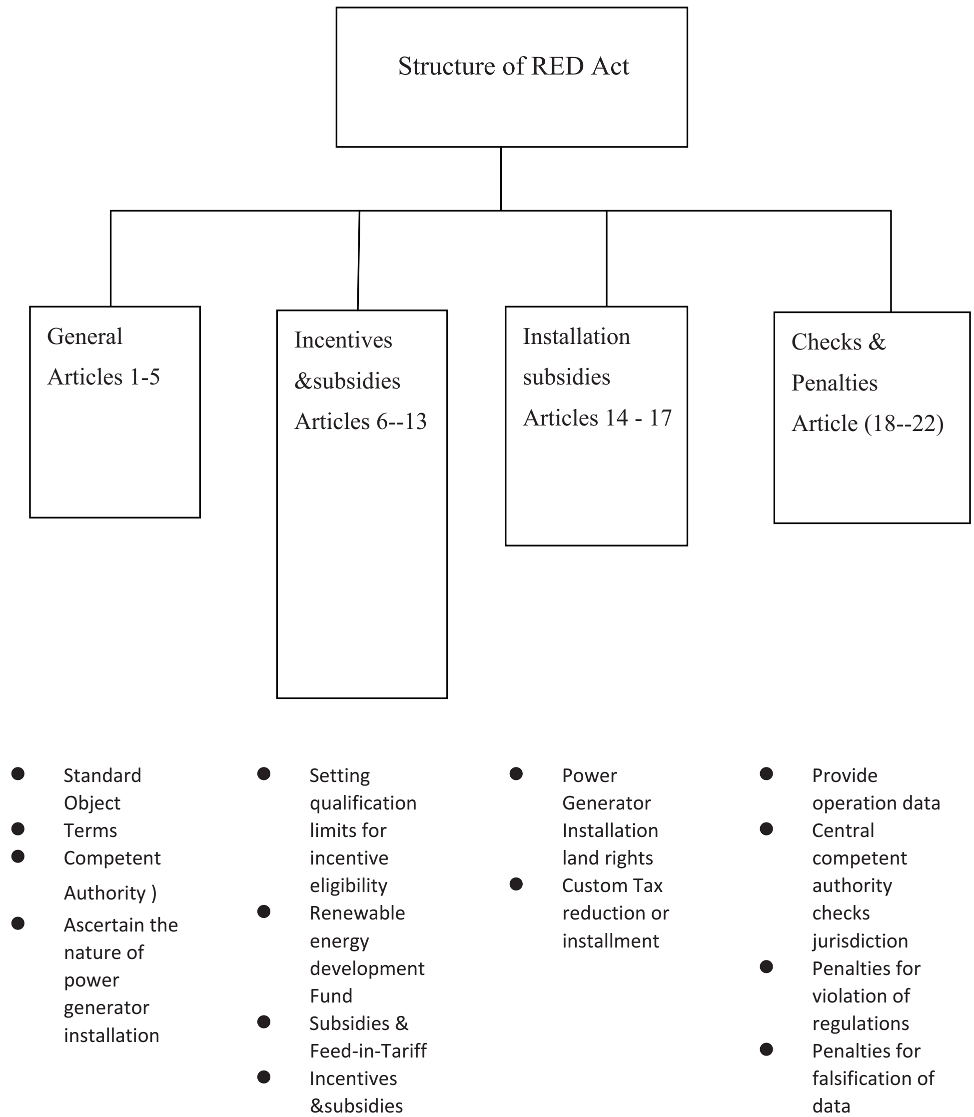


Fig. 6. Structure of renewable energy development (RED) Act. *Data source*: The author.

thermal energy or planting or manufacturing biomass energy (Section 13). Chapter 3 is concerned with supporting the installation of renewable energy power generators or providing electricity cable access (Section 14, Section 15). In order to encourage the installation of renewable energy power generators, Article 16 states that the tools, machinery, equipment and components needed to complete the installation should either be exempt from custom duties altogether or could be paid for in installments (Section 16). Chapter 4 of the act, deals with checks and penalties and stipulates that the competent authorities are to demand power installation practitioners to provide renewable energy operational data, as well as carry out checks (Section 18). The central competent authorities have jurisdiction to act as mediator and forcefully arbitrate disputes (Section 19). At the same time, violations of regulations or falsification of application information, will result in fines and penalties (Sections 20–22).

4.4. Drafting the Energy Tax Act

The issue of energy tax in Taiwan has developed in fits and starts. Following the call for energy saving and GHG reductions, the issue of energy tax was discussed during the 1998 National Energy Conference, yet it was not until the 2005 National Sustainable Development Conference that the importance of levying energy taxes was acknowledged. Currently the Act is under review at the House of Congress, having been submitted by a member of the opposition party in the Legislative Yuan in May 2008. However despite this, the draft has received significant attention from society as a whole; in particular with regards to this legislations aim to improve energy saving, reduce green house gas emissions, stabilize energy supplies, develop new forms of energy, develop a reasonable taxing system and so on. This act addresses many issues which are currently the focus of much academic attention and universally accepted to be vital to sustainable development, and is therefore accepted to provide an important framework for Taiwan in order to levy green taxes. This draft is made up of 25 Articles and separated into seven chapters, the most important first five chapters which deal with the Generals (Sections 1–6); chapter 2 sets out tax levying items and taxation (Section 7); chapter 3 regulates the applications of energy tax (Section 8); chapter 4 sets out checks and levying regulations (Sections 9–16); chapter 5 deals with penalties (Sections 17–21) (Fig. 7).

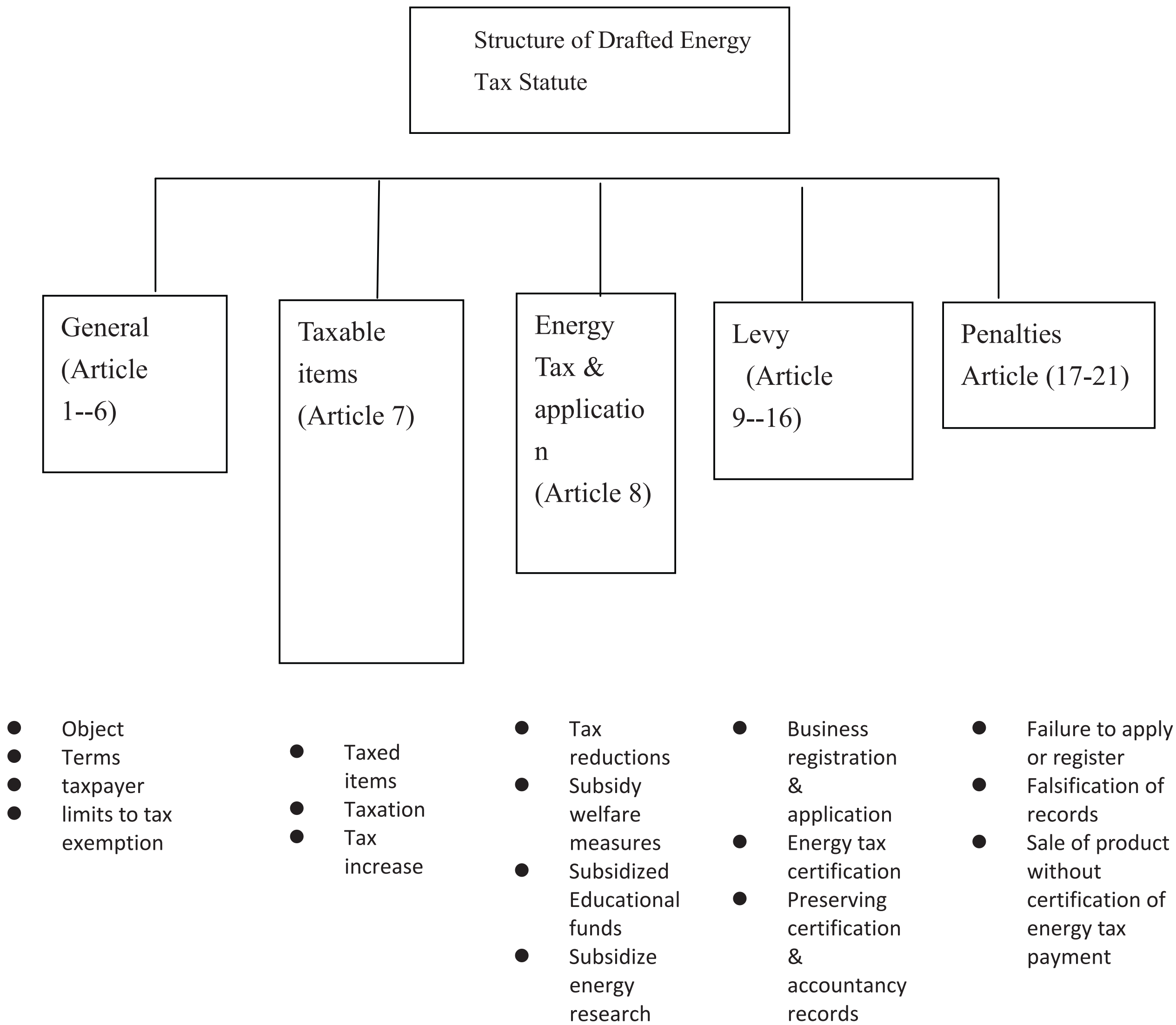


Fig. 7. Structure of drafted energy tax statute. *Data source*: The author.

Besides setting out the legislative aims of the act (Section 1), the Generals section also sets out regulations concerning taxpayer's status for paying tax on energy being dispatched from factories or imported along with tax exemption limits (Sections 4–5). Chapter 2 sets out the items on which tax should be levied, clearly stipulates the tax to be levied on petrol, diesel, airplane fuel oil, solvent oil, kerosene, liquefied petroleum gas (LPG), natural gas, fossil fuels, coal and the annual adjustments to be made to taxation rates (Section 7). The 3rd chapter includes regulations on the application of energy tax, including tax reductions and subsidies for low income households, increase in funds for educational purposes, energy saving transportation systems and subsidies for research into alternative energy sources (Section 8). All measures aimed at reducing greenhouse gas emissions and ensuring a balanced win-win situation between environmental sustainability and financial gain. The 4th chapter deals with regulations concerning the registering and application process for factories and businesses (Section 9, Section 10), receive energy tax payment certification (Section 11), retain energy tax certification and accountancy records (Section 12), pay outstanding energy tax and checks (Sections 14–16) on tax revenue procedures. The 5th chapter covers penalties, including fines or outstanding tax for falsification of information on application or registration form (Section 17), non-payment of outstanding tax or fines (Sections 18–20), sale of products not possessing energy tax certification (Section 21). This draft specifically stipulates that in the case that tax has already begun being levied, in order to avoid repeated levying of tax, customs tax and vehicle fossil fuel user fees should be suspended (Section 24).

4.5. *Drafting of Greenhouse Gas (GHG) Reduction Act*

4.5.1. *Legislative structure*

Following the Kyoto Protocol coming into effect on the 16th February 2005, Taiwan responded in the first year with the first draft of the 'GHG Reduction Act' (2006/2/16). This draft was submitted to the Legislative Yuan for review by the Department of Environmental Protection and its existence reveals the importance of international pressure for a legislative response to climate change. Currently, despite the differing versions of this legislation proposed by different legislators, the most recent version is the one submitted to the Legislative Yuan for review by the Executive Yuan on the 4th February 2008. This draft regulates six types of greenhouse gases, of which CO_2 emissions levels are the highest, accounting for 92.04% of all GHG emission. Due to the fact that 88.04% of CO_2 emissions are produced by the energy sector, the draft concentrates on energy related CO_2 emissions, while at the

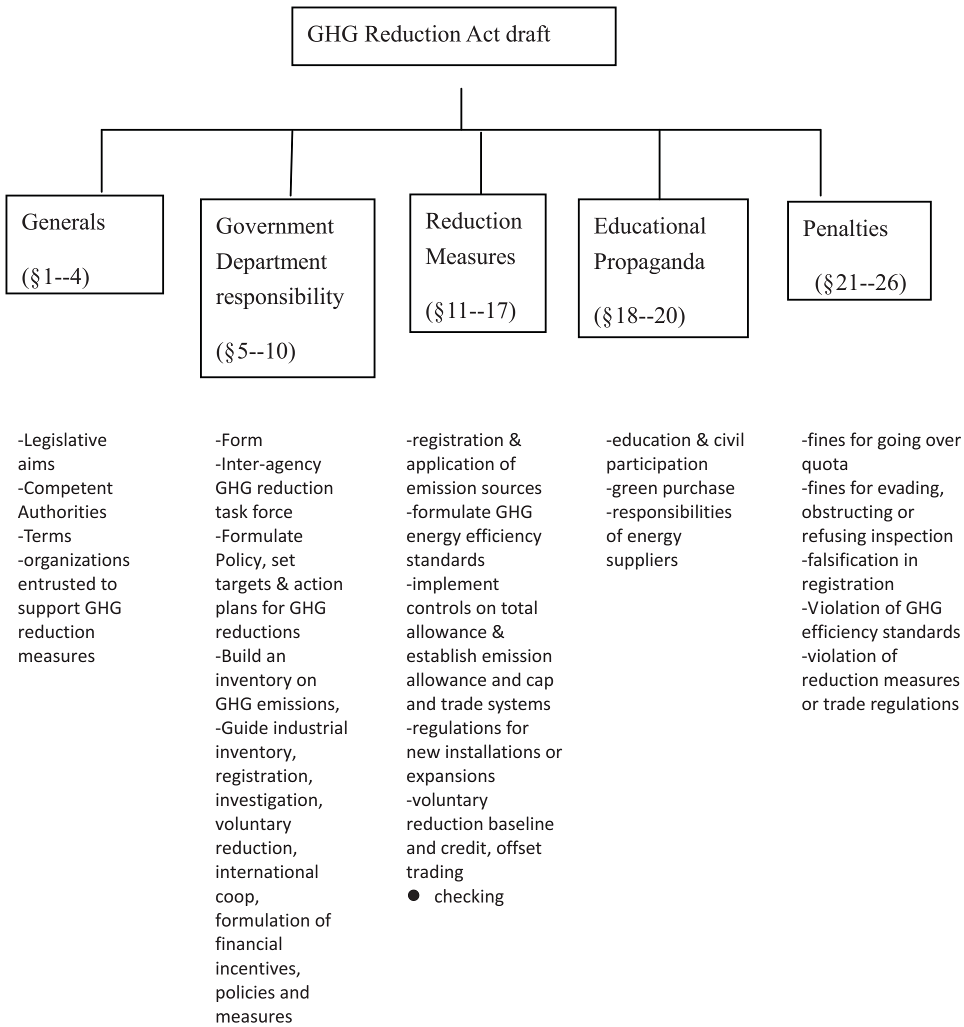


Fig. 8. Structure of the GHG reduction act draft. *Data source*: The author.

same time echoing the call of the other three pieces of legislation. This draft is made up of 28 articles and 6 chapters, including chapter one on Generals (Sections 1–4), chapter two on the authority of different government departments (Sections 5–10), chapter three on emission reduction policy (Sections 11–17), chapter four on educational propaganda (Sections 18–20), chapter five on penalties (Sections 21–26) and chapter six supplementary articles (Sections 27–28) (Fig. 8).

Chapter 1 on Generals clearly sets out its legislative aims of reducing global climate change, reducing GHG emissions and ensuring sustainable development domestically (Section 1). Similarly to the Kyoto Treaty, the draft identifies the six key greenhouse gases as CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 (Section 3). While at the same time stipulating that besides central and local competent authorities (Section 2), special jurisdiction should also be given to certain organizations to handle the reduction of GHG emissions (Section 4). Due to the fact that this draft is primarily aimed at establishing a government control framework, chapter 2 clearly lays out the jurisdiction of different government departments. The Executive Yuan is designated as the overall central relevant authority in promoting domestic GHG emission reduction policy, including policies related to developing renewable energy and related technology, energy efficiency and savings, along with various GHG reduction methods, financial tax incentive mechanisms and integrated assessments into the economic implications involved (Section 5) in such development. At the same time, the central competent committee (the Department for Environmental Protection (DEP)) should formulate policy for reducing GHG emissions (Section 6), collect national emission statistics at regular intervals, build a list of Taiwan's GHG emission sources and publish a national report on GHG emissions at three year intervals (Section 7). The competent authorities responsible for undertaking these central aims (including the Ministry of Economic Affairs, Energy Bureau and Ministry of Transportation) should work together to achieve these GHG reduction targets and implement action plans (Section 6); submit emission level survey and climate change adjustment strategy to the central competent authority (Section 7); examine, readjust and formulate economic incentives within the GHG reduction policy at regular intervals (Section 8); provide guidance for undertaking inventories on emission sources and levels, coordinating the inventory, registration and verification of voluntary reductions and international cooperation, to work towards a common reduction goal (Section 9).

The reduction policy in Chapter 3 shows that this draft adopts economic incentives as a control method, encouraging businesses to carry out annual inventories of emission levels and register these levels at regular intervals on the information platform set up by the central competent authority (Section 11). Moreover, annual levels of GHG emissions should conform to the GHG performance standard (Section 12). More specifically, in relation to establishing a carbon trade mechanism based on the international model, this draft stipulates that the central competent authority should for-

mulate controls to manage overall GHG emissions, and set up an allocation and carbon trade system (Section 13). At the same time, the competent authorities responsible for central aims should, at regular intervals, review the allocated allowances of various businesses, withholding a part of the total allocation allowance for new factory constructions or expansions to current facilities (Section 14). Businesses should adopt reduction measures and not surpass their allocated allowance or emission amount; surplus allowance could be traded on the central competent authorities' trade platform. In the event that emissions surpass allocated allowance, practitioners should purchase sufficient surplus allowance in order to off-set (Section 15).

Besides developing the overall emission controls and emission trading measure, also known as cap and trade, this draft also develops a baseline and credit system, encouraging businesses to be proactive in proposing GHG reduction plans, reduction targets and timetables. Once reached, these reduction targets must be checked and verified to ensure validity, before the amount by which their CO_2 emission has been reduced can be offset against their total allocated allowance (Section 16). This type of system, where businesses propose a plan for reducing emission levels and having been verified, this credit can then be used in trading, is usually known as project-based trading. Of the three types of reduction mechanisms set out within the Kyoto Protocol both the Clean Development Mechanism (CDM) and Joint Implementation Mechanism (JI) are both forms of project-based trading. Since Taiwan is not a Kyoto Protocol signatory state, Taiwan needs these regulations to encourage businesses to work within the framework of a CDM, cooperating and trading with the Protocol's Annex 1 Countries. In particular, this provides offset mechanisms for the construction of new factories or expansions of current facilities.

Chapter 4 regulates educational guidance and civil participation at different levels of government (Section 18); public institutions, schools and government owned enterprises in promoting energy saving measures and implementing green purchasing (Section 19); energy suppliers in encouraging energy saving and improving energy efficiency (Section 20). Chapter 5 covers the penalties for non-compliance, including fines and deductions on total allowance or emission quota for being over quota (Section 21), fines for evading, obstructing or refusing inspection (Section 22), fines for falsification of applications (Section 23), fines for violation of GHG efficiency standards (Section 25), fines for violation of reduction measures or trade regulations (Section 26).

4.5.2. Reduction measures: registering, environmental impact assessments (EIA) and the commitment to voluntary reductions

Carbon trading and voluntary reduction offset trade, are combined together within the GHG Reduction Act draft. While promoting the development of this legislation, Taiwan's government has also dedicated itself to developing various types of GHG reduction control models, which will in the future work alongside the legal aspect in government policy. As a result of the high energy intensity of Taiwan's Electricity, Refined Oil, Petroleum and Steel Industries, beginning in 2004, these industries became a key target of GHG reduction controls, with the government encouraging the registering of emission levels and implementation of voluntary reduction measures [21].

According to Article 11 of the current draft of the GHG Reduction Act, businesses can register their GHG emission levels on the central competent authority's information platform. The Environmental Protection Administration (EPA) officially launched the 'National GHG register platform' in July 2007, with the plan that within three years they would have a clear understanding of at least 80% of the Energy and Industrial Sector's GHG emission levels [22]. Therefore, until the GHG Reduction Act comes into effect, industries can adopt a voluntary reporting method for registering GHG levels. The government will also accept inventories from businesses and factories which have yet to be verified. This registering mechanism will help in future considerations of total emission quota controls.

In terms of voluntary reductions, although the GHG Reduction Act is still in the process of being reviewed, yet in light of the current structure of Taiwan's energy intensive industries and international pressure, the government must formulate its strategy immediately. In accordance with the regulations set out in Article 16 on Voluntary Reductions, the EPA has already taken the first steps in formulating 'Greenhouse Gas Early Action and Trade-off Promotion Principles (draft). The early action plan is aimed at the manufacturing process within energy intensive industries. Using an emission intensive method to calculate reductions, having passed the verification and checking stages, reduction credit can be collected. At the same time, trade-off plans offer a way for businesses to conform to the Clean Development Mechanism's (CDM) GHG reduction plan and once having passed the verification, validation and checking stages, the credit gained can be used to off-set against environmental assessment commitments, energy efficiency standards and future overall quantity controls [23].

Especially in recent years, as Taiwan has considered the initiation of new large scale development projects there has been a growing debate on the increase of GHG emissions. Despite the various reduction measures currently promoted by the government, the limited potential for actual reductions in the levels emitted by industry has led to the government allowing development projects to adopt special reduction methods for offsetting emission levels with the current draft of the 'GHG Reduction Act' stipulating that up to 50% of emission quota can be offset against emission quota purchased from abroad [24]. However this special reduction method, it is argued, is not really a reduction measure at all.

From this draft of the GHG Reduction Act along with the accompanying policy measures, we can see that the structure of Taiwan's GHG reduction controls, while on the one hand having developed international carbon reduction related systems and strategies, on the other have taken into consideration the structure of domestic energy intensive industries, with the hope that by adopting a progressive approach, the emission levels produced by these industries will conform to the cap and trade and off-set trade systems in place. Related development stages are planned as follows: Stage 1 voluntary registering of inventory and reductions, as promoted by the EPA prior to the passing of the GHG Reduction Act. Stage 2 forced inventory and registering with voluntary reductions, this plan will be implemented one year after the passing of the GHG Reduction Act. Stage 3 regulate energy efficiency of emission sources and implements GHG efficiency standards and offset trading measures, this plan will be implemented three years after the passing of the GHG Reduction Act. In Stage 4 the cap and trade measures are promoted while maintaining the offset trading [25] (Fig. 9).

4.5.3. The problem of CO_2 emission trade and CDM

Articles 13–16 of the GHG Reduction Act draft regulates the establishment of a system similar to that of the carbon trading mechanisms proposed in Directive 2003/87/EC [26] Article 17 of the Kyoto Protocol. While Article 16 of the draft which is related to voluntary reduction and offset trading, is also similar to the Linking Directive 2004/101/EC [27] Article 12 of the Kyoto Protocol which amends and expands on the concept of 'Joint Implementation' (JI) and 'Clean Development Mechanism' (CDM) and incorporates this into the EU's Joint Market Emission Trading System. According to the fact that both of these flexible mechanisms set out in the Kyoto Protocol highlight the obligation to reduce emissions, while using diverse methods to achieve this goal, including business' voluntary reduction of emission levels, purchasing of emission rights, or through specific climate protection investment plans, gain non-quota emission rights.

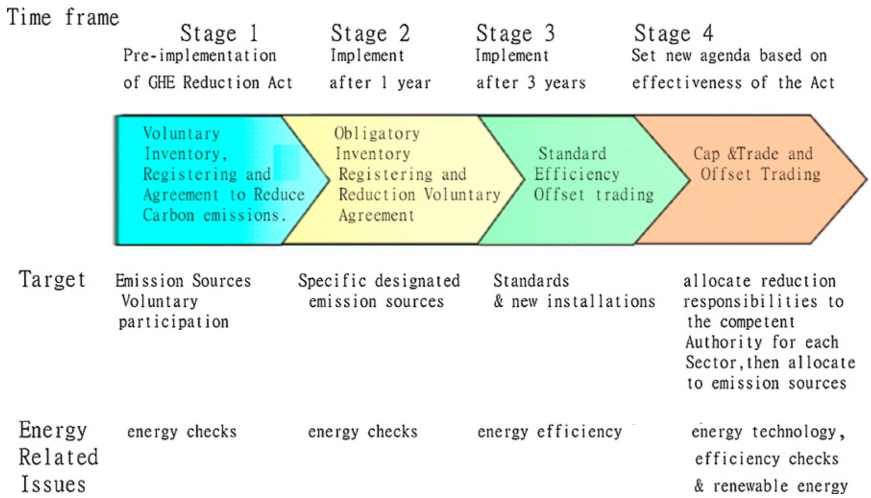


Fig. 9. GHG emission reduction and carbon trade routes. *Data source*: Refer to [25].

However, Taiwan's current GHG Reduction Act draft raises questions not only with regards to the setting of reduction targets, and the allocation of allowances as part of the total emission quota controls but also in relation to the proportion of offset trade within the CDM which can come from abroad. First, within the draft, there is no clear stipulation as to reduction targets. Although the Executive Yuan in May 2010 re-set CO_2 targets; setting the 2005 emission level as the target for Taiwan to return to by 2020, however the lack of international acknowledgement for this basis, means that doubts remain as to its validity. The EU's progress in regulating this aspect can be seen in the newly amended Directive 2009/29/EC[3] [28], where the EU Joint carbon emission levels should by 2020 be returned to the standard of 1990 and then reduced by another 20%. At the same time, if other developed countries are willing to set comparative targets, and developing countries to take on greater responsibility for reductions, then the EU will commit to reducing their CO_2 levels by 30%. This international trend reveals the extent of the pressure currently on Taiwan.

In relation to disputes over allocation allowances within the total emission quota controls, the Executive Yuan's draft version tends towards a grandfather clause implementing gratuitous allocation of allowances, with enterprises gaining free right from the government to emit pollution; comparatively, the version drafted by other legislators regulates that a certain proportion of allocated allowance (15%) could be retained and sold in auction or allocated as compensative allowance. According to the EU Emission Trading Scheme (ETS) implementation process, stage 1 (January 2005 to December 2007) retains 5% of the overall quota for auction; in stage 2 (January 2008 to December 2012) this percentage is increased to 10%[4] [28]. Although the EPA has promoted Taiwan's participation in the Framework Agreement for Climate Change, which in accordance to the EU ETS and Regional Greenhouse Gas Initiative (RGGI) would mean retaining a certain proportion of emission rights for auction or allocation, the legislative pressure faced for all quota to be allocated gratuitously has meant that this has not currently be achieved. The main advantage of Taiwan retaining a certain percentage of quota for auction is that besides considering the unfairness of gratuitous allocation, they would also enable new factory constructions to gain emission rights more easily.

Third, in the carrying out of voluntary reduction in CDM, according to Article 16 Item 2 of the Executive Yuan's draft, calculations of reduction quota, approval, off-set or trade are all formulated by the central competent authorities; while other legislator's versions are comparatively strict, stipulating that only 10% of reduction quotas can be offset or traded; or that reduction quotas are only allowed to be offset against the changes in emission levels caused by business' future new installations. At the same time, in light of the proportion of allowance offset through cap and trade internationally, in 2009 during the 3rd Session of the Legislative Yuan's a first draft was passed which revised the original 35% to 50%, giving rise to public debate and serious concern from environmental protection groups[5] [29].

5. Comparison of the four carbon reduction acts

In the process of constructing the legislation for Taiwan's set of 4 CO_2 Acts, legislators have had to take into consideration not only core factors of international development but also key aspects of domestic development, including GHG reduction, energy saving and efficiency, economic capacity, adjustments to industrial structure, the rising up of newly emerging green industry, changes in consumer habits and so on. Since Taiwan is not a member of the United Nations nor a signatory state to the Kyoto Protocol, in considering these factors, Taiwan needs to be even more cautious than other countries; therefore the legislative framework for the four GHG acts, not only possesses international CO_2 reduction responsibility plans, but also directly or indirectly constructs legal controls in terms of GHG emission institutional capacity.

[3] This most recent ammended version , in accordance with the Climate Action-Energy for a Changing World formulated by the EU Council's and introduced on the 23rd January, Article 27 stipulates that by 2020 GHG levels should be returned to their 1990 level and then reduced again by 20% [28].

[4] Moreover, according to the EU's 2009 ETS Directive 2009/29/EC, in the 3rd Stage (post-2013) besides working in accordance with Article 10 parts A and B regarding gratuitous allocation, part of the overall total should be sold through auction [28].

[5] Green Civil Action Alliance advocates that Taiwan should make greater reference to the US Californian Senator De Leon and the AB 1404 revision he proposed, which stipulates that no more than 10% of a company's total emission can be exchanged with quota purchased from other companies, while at the same time banning the purchase of credit from outside of national borders. However, the DEP believes that according to the EU 'Climate-Energy Package 2009/04/09' and the US Northeastern States GHG reduction advocates, it is possible through a third country's CDM and JI mechanisms to purchase carbon credit from outside of national borders, which can be traded off against up to 50% of carbon emissions [29].

Table 2
CO_2 four acts legal comparison (interaction and harmony).

Legal title comparison	Energy Management Act Amendments	Renewable Energy Development Act	GHG Reduction Act draft	Energy Tax Act draft
Legislative progress	08/07/2009 Promulgation	08/07/2009 promulgation	30/01/2008 draft submitted to the Executive Yuan for Review	05/2008 Tian QiuJin legislator proposed
Legal background	2005 National Energy Conference, 2006 Economic Sustainable Meeting, 2008 Sustainable Energy Policy Framework, 2009 National Energy Conference	2005 National Energy Conference, 2006 Economic Sustainable Meeting, 2008 Sustainable Energy Policy Framework, 2009 National Energy Conference	1998 National Energy Conference, 2005 National Energy Conference, 2006 Economic Sustainable Meeting, 2008 Sustainable Energy Policy Framework, 2009 National Energy Conference	1998 National Energy Conference, 2006 Economic Sustainable Meeting, 2008 Sustainable Energy Policy Framework, 2009 National Energy Conference
Legal aim	Article 1 states to achieve energy efficiency saving and effectiveness standards, energy technology research and incentives and subsidies	Article 1 states to increase energy diversity, promote renewable energy, and change the energy structure	Article 1 states the main aims are to formulate national GHG cap and trade, encourage voluntary reductions	Article 1 states that through levying tax on energy sources, achieve energy use efficiency, decreasing GHG emissions
Control model	Administrative controls	Economic incentives	Administrative controls and economic incentives	Administrative controls
Standard target	Energy suppliers (Section 6, Section 7), Energy users (Section 8–Section 12, Section 16, Section 18), Energy user equipment (Section 14, Section 15), New buildings (Section 17)	Installing renewable energy installations (Section 6–Section 17), renewable energy heaters (Section 6, Section 13)	GHG emission sources (Section 3) energy, industries, transportation and commercial sector (Section 8)	Domestic industries or imported energy factories and businesses (Section 4, Section 5, Section 6)
Competent committee	Department for Economic Affairs Bureau of Energy	Department for Economic Affairs Bureau of Energy	EPA	Department of Finance
Energy saving/energy efficiency standards/GHG reducing effectiveness standards	Section 8 energy efficiency and saving		Section 5 Central competent authorities promote energy user efficiency, energy saving, low carbon energy	Section 4 tax should be levied on energy coming from factories or imported from abroad.
	Section 14, Section 15 manufacturers or importers of energy equipment, apparatus, vehicles should conform to energy consumption regulations and clearly indicate energy consumption and efficiency on the packaging		Section 12 enterprises should conform to GHE efficiency standards;	
	Section 16 energy users developing new facilities or expanding on already existing factories should pass approval and verification processes; an energy user manual should be produced		Section 18, Section 19 educational propaganda, promoting energy efficiency and the use of low energy consumption energy efficient products	
	Section 17 energy saving standards for new buildings.		Section 20 for energy users: encourage effective use of energy, improve user efficiency	
	Section 18 limited standards for central air conditioning system			
Overall emission reduction controls	Section 1 formulate energy development framework	Section 6 promotion and incentives for installations of 6.5 million kilowatts to 10 million kilowatts.	Section 6 Central competent authorities depend on national economic, energy, environmental situation formulate reduction targets and action plan.	
	Section 15–1 Regulate national energy supply capacity and efficiency, exploiting energy sources and user assessment overall aims		Section 13 Central competent authorities implement overall emission controls; establish emission level allocation and trading system.	
Economic incentives/subsidies and supplements	Section 10 cogeneration excess power purchasing method, tariffs and obligations	Section 8 renewable energy power generator installations grid connection and purchasing obligations	Section 5 Executive Yuan and Central Authorities rights and responsibilities integrated and formulate GHG reduction financial incentives system.	Section 8 energy tax makes use of double mutual benefit, including allocation welfare, subsidizing alternative energy development research, supplement energy policy research

Table 2 (*Continued*)

Legal title comparison	Energy Management Act Amendments	Renewable Energy Development Act	GHG Reduction Act draft	Energy Tax Act draft
		Section 9 Feed-in-Tariff	Section 8 Economic incentive policies adopted by the Central Industry Competent Authority to encourage GHG reductions in the energy, industrial, transportation and commercial sectors	
		Section 11 Renewable energy technology incentives.	Section 9 The Central Industry Competent Authority provides guidance for practitioners in measures for implementing voluntary reductions and involvement in international cooperation to provide incentives or subsidies	
		Section 13 heat energy incentives and subsidy legislation (solar power, bio-energy)	Section 13 Central Competent Authority implements controls on total emissions, setting up emission level checks and cap and trade; Section 16 enterprises voluntary reduction offset trading	
		Section 16 exemptions on custom tax		
Funds and application	Section 5 set up energy research development special fund, for the purpose of energy development, energy saving technology or alternative energy research	Section 7 set up a fund for developing renewable energy development, for providing subsidies for setting up installations and price tariffs for renewable energy; supplements for models and promoting	X	X
	Section 5 1 fund source: power, petroleum, oil refinery, transport industry			
R&D encouragements	Section 5 energy research development special fund	Section 7 renewable energy development fund and source	Section 5 Executive Yuan and Central Competent rights and responsibilities: RE and energy S&T development, GHG reduction technological R&D	Section 8 energy tax used to subsidize alternative energy development research, supplementing energy policy research
Limits to jurisdiction to test check and develop statistics on. . .	Section 9 Stipulates energy users establish a system for checking energy; Section 12 stipulates energy users report energy use related documents	Section 18 Stipulates the right for central authorities to implement checks on renewable energy users	Section 7 Stipulates the central authority survey emission levels, calculate national emission levels and establish an inventory on emissions	Section 12 Stipulates businesses or factories manufacturing or processing energy should keep related account books, certification and other related data to be checked by the competent authority
			Section 17 Stipulates the government the jurisdiction to examine or demand enterprises provide related data	Section 15 Stipulates that factories and businesses producing energy failing to register their monthly energy tax would come under survey by the competent authority
New and expanded facilities and updated installations	Section 14, Section 15 producing factories or importers of energy related equipment, apparatus or vehicles should conform to energy consumption regulations, clearly indicating the products' energy consumption levels and efficiency	Section 12 stipulates in the building of new facilities or reconstruction of public projects or public buildings, the installation of renewable energy power generator should be prioritized	In terms of newly built facilities or changes to emission source:	X
	Section 16 an energy user manual should be made for energy users building new facilities or expanding on current facilities setting out the process of approbation Section 17 new buildings should adhere to energy saving standards	Section 16 Renewable energy generator installations are exempt from custom tax	Section 14 The Central Industry Competent Authority announce checks, retaining a part of the allocated allowance for new facilities or updates made to emission sources Environmental assessment promise	

Table 2 (*Continued*)

Legal title comparison	Energy Management Act Amendments	Renewable Energy Development Act	GHG Reduction Act draft	Energy Tax Act draft
			Section 16 enterprises voluntary reduction, apply for reduction credit, once verified this credit can be offset against trade	
Access to emission level data	X	X	Section 11 enterprises should periodically register emission levels on data platform; registered data should be checked and verified	Section 4 states that tax should be levied on energy from factories or imported from abroad Section 9 before starting to manufacture energy, factories or businesses should first apply and register with the competent authority responsible for levying taxes

Data source: The author.

At the same time, in the process of promoting this legislation, in accordance with the various types of legislative standards and policy, administer the stages of the comprehensive plan, while also strengthening the position of the four GHG acts is the integrated institutional potential for reducing GHG emissions. In this context, we will compare and analyze the four GHG acts, their functions and standards, including consideration of their development, legislative background, legislative aims, control procedures, standard objects and authorized agency. Moreover, in relation to the legal standard functions, we will compare the harmony and interaction produced by these four acts including in relation to energy efficiency and GHG efficiency standards, total emission quota controls, economic incentives and subsidies, funds and uses, central verification jurisdiction, statistic limits, new constructions and expansions, research and development (R&D) and spread of technology, emission allowance (refer to Table 2) to investigate the development of Taiwan's CO_2 Reduction legislation.

5.1. Legislative background and aims

The progress of the four GHG reduction acts simultaneously has connotations for the promotion, measures and related considerations in government policy. The earliest response to the legal and strategic changes developed in the Kyoto Protocol came after the 1st National Energy Conference with the drafting of a new law to control GHG emissions and researching the possibility of levying tax on energy use. However, the implementation of these legislative changes has been relatively late in coming. During the 2005 National Energy Conference, with the added pressure of the Kyoto Protocol having already come into effect, readjustments were actively made to policy, including to traditional energy structures and improving energy efficiency. While under a framework for developing green energy, not only were proposals made for amendments to be made to the Energy Management Act, Renewable Energy Development Act and GHG Reduction Act, but also for the establishment of a GHG Reduction Office. In this move towards global trends of CO_2 reduction and green energy and industry, the beginning of this CO_2 reduction law movement within key inner government circles, led to overwhelming support at the 2005 Economic Sustainable Conference with demands for an Energy Tax Act to be drafted and subsidies and preferential policies for petroleum energy to be suspended. All of which gave further momentum to the promotion and development of the four GHG acts. Following this was the 2008 Framework Policy on Sustainable Development, and the 2009 National Energy Conference which reached further consensus on the constructing of this set of four GHG reduction acts and enabling Taiwan to begin and take on further responsibility internationally for reductions in GHG as part of a goal for joint but different responsibilities. The amendments to the Energy Management Act and Renewable Energy Development Act were passed in June 2009.

As for the legislative aims, the Energy Management Act is mainly concerned with facilitating Taiwan in reaching its energy efficiency standard, maintaining its total quota controls for energy users, conducting energy technology research, and implementing incentives and subsidies. The Renewable Energy Development Act in contrast is more concerned with increasing energy diversity, promoting renewable energy and changing the structure of energy sources. The current draft of the GHG Reduction Act is focused on formulating a national promotion scheme, regulating total quantity controls and trading, encouraging voluntary reductions, green purchase and educational propaganda. Finally, through a green taxation system which levies taxes on different energy sources, the Energy Tax Act aims to facilitate in reaching the energy user efficiency, developing alternative energy, changing consumption habits. In fact, all four of these acts possess the common aim of reducing GHG emissions, the only difference is in the control procedures, main target, competent authority or standard aims.

5.2. Control model and main target for regulations

The Energy Management Act uses an administrative control model, the competent authority is the Ministry of Economic Affairs, its main targets are energy suppliers (Section 6, Section 7), energy users (Section 8–Section 12, Section 16, Section 18), energy user equippers (Section 14, Section 15) and new buildings (Section 17). The Renewable Energy Development Act adopts subsidies and subsidizing policies as economic incentives, its main competent authority is the Ministry of Economic Affairs and its main target is those installing renewable energy installations (Section 6–Section 17), renewable energy users (Section 6, Section 13). The draft of the GHG Reduction Act adopts administrative controls and a model of economic incentives, including total quota controls and carbon trade, voluntary reductions and CDM. The Department of Environmental Protection is the competent Authority and the main targets are all sources of GHG emissions (Section 3), including energy, industry, transportation, commerce and so on (Section 8). The draft of the Energy Tax Act adopts an administrative control model for developing a new taxation system for levying taxes on energy. Its main targets are domestic energy producers and foreign energy import businesses (Section 4, Section 5, Section 6) in order to change energy consumer habits.

5.3. In practice: the harmony and interaction between the four acts

These four acts all have a clear mutual standard function which is to reduce GHG emissions. And this standard procedure basically revolves around standard settings, administrative incentives, administrative checks, encouraging R&D and other factors. Therefore, we can synthesize the overall similarities of their standard policies and discuss the similarities of these laws with regards to control method, scope and functions, to grasp the direct or indirect tendency towards reaching GHG reduction targets. At the same time, areas of contention between these four acts in terms of standard targets should be altered.

5.3.1. Energy saving, energy efficiency and GHG efficiency standards

In terms of the direct and overall effectiveness of these four acts in practically reducing CO_2 emission levels, the Energy Management Act emphasizes energy savings and energy effectiveness standards. Chapter 3 Article 8 regulates the energy user efficiency and energy saving; Articles 12 and 15 set out the energy consumption standards which factory production or imported energy equipment, apparatus, vehicles should conform to as well as regulations concerning the marking of products with energy consumption and efficiency levels. Article 16 introduces regulations for examining and approval of new installations and expansions on current factories in terms of energy consumption levels. Article 17 stipulates the need for new buildings to conform to energy efficiency standards while Article 18 outlines limits to central air-conditioning systems standards.

In comparison, while the GHG Reduction Act draft also aims to regulate energy efficiency and savings, yet its main concern is with controlling standards measuring the effectiveness of methods for reducing GHG levels. Chapter 2 Article 5 states that central competent authorities could promote energy use efficiency, energy saving and low carbon energy. Articles 18 and 19 regulates educational guidance in terms of promoting energy saving and the use of low energy consumption, highly energy efficient products. Article 20 provides for various forms of energy, encourages energy saving and improve user efficiency, while Article 12 sets out the GHG efficiency standard that enterprises should conform to.

However potential crossover still exists between the Energy Management Act and the current draft of the GHG Reduction Act which are in need of attention. The main targets of the Energy Management Act are the energy producers, whereas the GHG Reduction Act draft goes one step further by directly targeting the relevant industries and implementing mechanisms to ensure the effectiveness of CO_2 reduction. According to the current control standards set out in the Energy Management Act, enterprises need to indicate the energy consumption and efficiency of products, while the GHG Reduction Act regulates that emission sources should conform to GHG effectiveness standards, which ensure that measures adopted to increase energy efficiency and energy saving are effective in achieving these aims. Since both of these Acts offer the incentives of credit or quota in exchange for verified reductions in emission, then the question which must be considered is how should these two acts be synthesized; if an enterprise has already complied to the regulations set out in the Energy Management Act, then surely they should be eligible to gain credit even before they have complied to the effectiveness standards set out in the GHG Reduction Act. The relevant competent authorities need to review the consistency of these standards, to avoid the repeated regulating of enterprises, increased administrative costs or administrative difficulties [30]. Since the GHG Reduction Act remains a draft, further revisions should be made to this draft before being passed in order to ensure that it is in complete harmony with the regulations already stipulated in the Energy Management Act.

As for the Renewable Energy Development Act, its legislative aims and functions encourage green energy development and energy diversity, to reduce Taiwan's dependency on fossil fuel based energy structure, therefore overall this can be seen as a way to indirectly increase the effectiveness of reducing GHG emission levels. In relation, Article 4 of the Energy Tax Act regulates that tax should be levied on energy as it is exported from the factory or imported from abroad, to reflect the external costs of GHG emissions, as well as important laws and regulations which directly reduce levels.

5.3.2. Total emission controls

In terms of the aim of drafting regulations governing controls for total emission allowances, the regulations set out in Article 1 Item 2 of the Energy Management Act states that the central competent authority could draft a Framework on Energy Development, while Article 15 Item 1 further regulates national energy supply capacity and efficiency, setting out the overall aim to establish assessments for reviewing energy source development and energy use. The Renewable Energy Development Act formulates comprehensive incentives to be administered stage by stage, as a strategy to encourage development of clean energy sources. Article 6 stipulates that generated power installations with a capacity of between 6.5 million kilowatts to 10 million kilowatts are eligible for incentives; while for installations with a capacity of 5 million kilowatts and above, the central competent authority could examine and implement adjustments in relation to overall efficiency or technological development. Article 6 of the GHG Reduction Act draft stipulates that reduction targets and action plans formulated by the central competent authority are to be based upon the national economic, energy and environmental situation. While Article 13 gives jurisdiction to the central competent authority to implement GHG Emission Allowance Controls, to establish emission level checks and trade system jurisdiction limitations.

5.3.3. Economic incentives, supplements and subsidies

While the control models formulated within each of these four acts are clearly different, the subsidies, supplements, feed-in tariffs and other economic incentives set out within are relatively complementary. And once passed these different economic incentives will assist in promoting and controlling aims. These different economic incentives, can work as tools to achieve control targets, while also directly or indirectly having an overflow effect, helping secure a number of legislative aims including: greater energy efficiency, energy pluralism, development of renewable or alternative energy sources, as well as ensuring overall GHG reduction. Article 10 of the Energy Management Act regulates the tariffs, obligations and methods for purchasing surplus energy from cogeneration (combined heat and power, CHP), encouraging the use of alternative energy as well as greater energy diversification. The main incentive tools drafted into the Renewable Energy Development Act are: the purchasing obligations for renewable energy development generators installed on the grid stipulated in Article 8; the feed-in tariff method regulated in Article 9; incentives provided to encourage the building of renewable energy generator technology models, set out in Article 11; subsidies and incentives for using solar energy and biomass energy in Article 13 and exemptions from custom tax when importing renewable energy generator installations or parts, as regulated in Article 16.

The economic incentives aspect of the GHG Reduction Act draft can be separated into two parts. In Chapter 3 Article 13 it states that the central competent authority's total emission allowance controls, the setting up of emission level checks and trading systems and the allocation of emission quota to enterprises are legal founda-

tions for the competent authority to intervene in the private sector to implement reductions and cap and trade measures. At the same time, Article 16 states that before enterprise emission level checks are in place, voluntary reduction plans as well as actively proposing GHG reduction plans, reduction levels, phases, verification, applications for reduction credit, along with agreements to allow verified quota to be off-set or traded are key legal foundations for ensuring enterprises cooperate with GHG cap and trade and offset trading standards. Moreover, Article 5 stipulates that the Executive Yuan and central competent authority are to integrate and formulate a tax incentive mechanism for encouraging GHG reduction; while Article 8 regulates the economic incentive policy adopted by the responsible agency for enterprises affected by this new legislation, to support their adoption of energy, production, transportation and commercial reduction policies. Article 9 stipulates that the agency responsible for enterprises affected by new legislation is to guide said enterprises in adopting voluntary reduction and participating in international cooperation measures to ensure GHG reductions; as well as providing incentives and subsidies to support enterprises. The section of the Energy Tax Act draft addressing subsidies is comparatively open, with two forms of energy tax, green tax and reallocation tax. Act 8 stipulates energy taxation should be applied to household income redistribution, as an important tool for subsidizing alternative energy development research and energy policy research to encourage and promote society to accept energy tax.

5.3.4. The establishing a fund and its use

In this form of legislation it is normal to give the competent authority jurisdiction to establish a special type of fund to be used in implementing policy; this is a form of regulating tool. In the Article 5 of the Energy Management Act with its focus on administrative controls, it stipulates the setting up of an energy research development special fund; stating that the electricity, petroleum refinery and petroleum import industries would be the financial source for this fund. The use of this fund would be in the development of new forms of energy, energy saving technology or alternative energy research, energy economic analysis and professional training. This regulation ensures that the Energy Management Act besides providing controls on energy practitioners also strengthens energy development research. In the same way, the Renewable Energy Development Act, which adopts the model of economic incentives, in Article 7 also stipulates the setting up of a renewable energy development fund. Funding would come from the power generator industry and its main purpose would be in supporting the aims set out within the act, in promoting the development of green energy subsidies and supplements. This includes promoting renewable energy power prices, and subsidies on installations, renewable energy models and use. Moreover Article 11 provides incentives for promoting renewable energy technology possessing development potential.

5.3.5. R&D incentives

The setting up of and designated use of the funds which the 'Energy Management Act' and 'Renewable Energy Development Act' stipulate, are focused on funding research into energy savings methods, as well as alternative and renewable energy. Both acts tend towards the standard target field of energy to promote the improvement and spread of technology, to help ensure energy efficiency and green energy development. From a comprehensive view of various countries, it is clear to see that when a government invests increasingly in research on energy savings, renewable energy (solar, wind, bio, ocean energy and so on), in order to improve the competitiveness of renewable energy technology and productivity, these subsidy policies become a vital tool in enabling the government to cultivate its industries. With regards to research development, take the EU's FP7 as an example, the EU and its member states invested large amount of funds into related new energies, renewable energy research plans, setting 2020 as a target for becoming the global lead in energy technology; while in terms of adopting subsidy policy, like Germany or Japan involves large scale subsidizing of solar power, successfully cultivating its position as global technology and market leader [31,32]. In contrast, although Taiwan has already administered research subsidies and supplement policies, yet this is the first time that it has been written into Taiwanese law as a clear regulation.

The GHG Reduction Law draft is mainly designed to regulate a cap and trade system. Although in Article 5 it stipulates that the central competent authority promote renewable energy and energy technology development as well as R&D into GHG reduction technology, yet there is nothing regulating the setting up of a special fund, nor is there any related regulation. As for the Energy Tax Act draft, with its double dividend design, Article 8 stipulates that energy tax should be used to subsidize alternative energy, research into energy policy while expanding and encouraging R&D. Of these four acts, it is the Energy Management Act along with the Renewable Energy Act which are the main references for encouraging the spread of technology and increase of R&D into renewable energy, energy savings or energy efficiency; the other two acts do not directly regulate this aspect. However, in the future the 'GHG Reduction Act' could strengthen its emphasis on subsidies and incentives for conducting R&D into fields such as carbon reducing technology or carbon capture and storage technology.

5.3.6. Limits to jurisdiction for central checks and balances

Each of the four GHG reduction acts possesses articles regulating the registering, counting, testing and checking of energy related or GHG emission data by the central competent authority. The checks and balances jurisdiction incorporated into these acts are vital tools for ensuring the competent authority's overall energy saving targets are met; renewable energy forms are developed and GHG emissions are reduced. If the energy related and emission allowance inventories set out within the four acts were actually carried out, they would have a high degree of harmony within the four acts in terms of regulating and controlling policy, S&T assessments and reduction levels. For instance, the GHG emission inventory set out in Taiwan's Air Pollution Control Act has already become an important reference for categorizing GHG emission industries, identifying and setting reduction targets.

Article 9 of the Energy Management Act which stipulates that energy users establish an energy check system, as well as set energy saving targets and plans, has already given the central competent authority the right to check progress. Moreover, Article 12 stipulates that energy users submit user energy data, to enable the government to work out Taiwan's total energy consumption levels. Article 18 of the Renewable Energy Development Act stipulates that practitioners have an obligation to provide data on the operation of renewable energy, while the central competent authority has the right to carry out checks. Article 7 of the GHG Reduction Act draft stipulates the Central Industry Competent Authority carry out emission level surveys, the Central Competent Authority organize national emission level statistics at set intervals and establish a national GHG emission inventory; writing a national report every three years. At the same time, Article 17 stipulates the government has the jurisdiction to inspect enterprises' data or enjoin enterprises to submit relevant information. Article 12 of the Energy Tax Act stipulates that factories and businesses producing or manufacturing energy should keep their tax declaration accounting books, certification and other related data for inspection by the competent authorities. Article 15 stipulates in the case of energy producers and manufacturers failing to declare monthly energy tax, a survey should be carried out by the central authorities. These regulations

not only give the government access to total emission level data, but also the administrative right to inspect and check.

5.3.7. New facilities, expansions or upgrading of equipment

The four GHG reduction acts each include regulations regarding controls on GHG emission level increases caused by the building of new facilities, the expansion of current factories or the introduction of new equipment; these regulations are complementary, working together to directly or indirectly reach emission reduction targets. Articles 14 and 15 of the Energy Management Act sets out regulations regarding the energy efficiency standards that should be conformed to in factory manufacturing or importing of energy related equipment, machinery or vehicles, as well as stipulating that energy consumption and efficiency levels should be indicated on packaging. While Article 16 stipulates energy users installing new facilities or expanding on current facilities where it would effect the national overall energy supply demand structure and have a serious effect on the regional balance of GHG emissions, should receive an energy user manual and their application examined and approved. Article 17 stipulates newly constructed buildings should conform to energy saving standards. Item 4 states in order to control the increase of GHG emission levels. According to article 12 of the Renewable Energy Development Act newly constructed or reconstructed public projects or public buildings, should prioritize renewable energy generator installation. Article 16 sets out custom tax exemption regulations on renewable energy power generator, encouraging practitioners in related industries to import non-high energy consumption power generator installations, indirectly reducing emission levels.

While the total GHG emission control framework set out in the most recent draft of the GHG Reduction Act provides an emission allowance standard for enterprises planning to expand on current facilities, build new factories or update equipment. Therefore, in Article 14 it stipulates when announcing allocations, the central industry competent authority should retain part of the allocated allowance to allocate to new projects or enterprises which involve creating new emission sources. Article 14 also requires enterprises use the best technology available to work to limit domestic emission levels. Moreover, when installing factory expansions or new facilities, businesses could voluntarily promise to complete an environmental impact assessment to keep emission levels to a minimum. Article 16 requires enterprises to propose GHG reduction plans, set targets and periodical voluntary reduction promises, with the opportunity to apply for credit based on the extent of emission reduction achieved, which once verified can be used to offset against trading. The latter is one of the conditions of passing the environmental impact assessment, which in turn helps in grasping the relationship between economic development and GHG emission levels.

5.3.8. Access to data on emission levels

There is also a need for the GHG Reduction Act and the Energy Tax Act to be mutually compatible in their regulations with regards to access to emission source data. Article 11 of the GHG Reduction Act stipulates enterprises should periodically register their emission levels into an information platform set up by the competent authority. The registered data should then be verified by an inspection agency. While Article 4 of the Energy Tax Act stipulates tax should be levied on dutiable energy from factories or imported. Article 9 stipulates before energy factories or businesses begin producing energy, they should apply to register with the competent tax agency. Thus these two acts both work on a process of factories and businesses registering and verifying, registering tax affair data, with regards accessing emission level data.

In terms of the administrative management aspect of accessing emission level data [30,33], according to the cap and trade mechanism in the GHG Reduction Act, practitioners in order to gain comparatively high overall allowance allocations, tend to report their emission levels as being higher than in reality they are. At the same time different agencies also need to carry out inventories and verification on the GHG emission levels registered by enterprises. In comparison, since the Energy Tax Act is simply focused on energy applied taxation and levies, practitioners in order to avoid tax, tend to report figures lower than in practice. Due to this the competent authority besides avoiding the administrative costs involved in repeated inventories and verification of these figures; they are also more able to grasp the actual GHG emission level. Take Taiwan's fee system against air pollution for example, practitioners having paid the pollution tax on the emission level reported, have already gradually formed the basis of total control data. Therefore, it is advocated that in the future Taiwan should first implement its energy tax system, before executing the regulations laid out in the GHG Reduction Act, in order to show the complementary advantage of these two acts.

6. The pressures and effectiveness of the 4 carbon reduction acts

The background and progress of these four GHG acts demonstrate Taiwan has already entered the intermediate stage of complete construction of energy legislation. As a result of a move internationally towards energy liberalization, GHG reduction laws and implementation of related green tax system, Taiwan, being a trade-led newly industrialized country, is not only under increasing pressure internationally, with the potential of facing international sanctions if failing to develop greener trade, while at the same time facing the reality of Taiwan's current domestic energy structures and the challenges of altering the nation's industrial framework, with pressure to establish green energy industries. It is clear to see that between 1998 and 2009 a number of important S&T conferences have been held domestically on the issue of national energy. Taiwan's government has been relatively pro-active in proposing all kinds of policies and legislation in response to the challenges mentioned above. This shows that besides the obvious impact of international treaties which have seen Taiwan forced to accept the internationally accepted notion of mutual but different responsibilities for carbon reduction, and the attempted accumulation of capacity and potential for bringing about actual reduction in CO_2 emission levels, the role of the domestic economy as a consideration and pressure is also undeniable. Therefore, we need to move on from legal comparisons, to bring together different mutually compatible policies, only then can we grasp the true effectiveness of these four GHG reduction acts. While on the other hand, the pressures and challenges faced as this legislation is pushed through can also influence or obstruct the promotion of this legislation. In the following section we will discuss the structural problems existing within these four acts from varying horizontal, vertical and socio-cultural perspectives.

6.1. Implementing the policy before it is officially passed as law and its legal effectiveness

In order to promote amendments and legislation, the Taiwan government often adopts the measure of first implementing the policy before it is officially passed as a law, formulating various administrative rules and development strategies; on the one hand considering the adjustments being made to the industrial framework to fit the new legislation, while on the other first adopting a strategy of administrative incentives, to work alongside the legal system. At the same time this type of combination of policy and legislation often leads to systematic expansion with the policy and

Table 3
2007 Executive Yuan S&T Industry Strategy Conference.

Promoted item	2006		2010		2015		2025	
	10,000 kW	%	10,000 kW	%	10,000 kW	%	10,000 kW	%
(1) Normal hydropower	191.1	5.1	216.8	5.7	226.1	5.1	250	4.4
(2) Wind power	20.37	0.5	98	2.6	148	3.4	300	5.3
(3) Photovoltaic power	0.16	0.0	3.1	0.1	32	0.7	100	1.8
(4) Geothermal power	–		–		1	0.0	15	0.3
(5) Biomass power	60	1.6	74.1	1.9	85	1.9	140	2.5
(6) Fuel cell	–		–		5	0.1	20	0.4
(7) Marine energy power	–		–		0.1	0.0	20	0.4
Total	271.6		391.0		497.2		845.0	
Renewable energy generated capacity target as percentage of total generated capacity	7.3%		10.3%		11.2%		14.9%	

Data source: The author.

legal capacity for GHG reductions gradually enabling industries and government to reach their GHG reduction targets. With this type of procedure in place, the Executive Yuan can promote their strategy through a series of professional conferences. At the same time it is worth remembering that the government remains relatively weak in handling the pressure applied by various interest groups, and can be seen as currently belonging to the early policy legislation stage.

During the 2005 National Energy Conference there were calls for a fourth stage of amendments to be made to the Energy Management Act, with the main focus being on improving the effectiveness of energy use and adjusting energy structures. At the same time promoting amendments to this act, this conference also set goals for improving energy efficiency s by 2% a year, developing green transport system and Taiwan's LED industry, indicating the energy efficiency of products and encouraging policy targets for new buildings etc.; with the Energy Bureau developing various strategic tools. Following this the Energy Bureau promoted various industries and service plans as energy markers, that is to say, the process of these legislative amendments has not occurred removed from other activities, but rather has been closely linked in with the rise and development of Taiwan's green industry, with the purpose of simultaneously cultivating industry and reducing GHG emissions, in an all out win-win situation. Therefore it is safe to say that the amendments being made to the Energy Management Act are aimed at improving energy and user efficiency as well as promoting energy saving and energy efficiency technology, creating a structural GHG reducing function.

And this tendency to first implement the policy before it has been officially passed was even more obvious in the passing of the Renewable Energy Development Act in June 2009. In Taiwan's 1998 White Paper, the government began to actively planning the development of renewable energy, predicting that by 2020 renewable energy capacity would have reached 1–3% of all generated capacity and that within five years the government would invest $10 billion Taiwanese dollars in research into new energy forms and clean energy, using financial incentives such as tax savings as policy tools for promoting renewable energy. Within this context, beginning in May 2000 the Department for Economic Affairs began a series of 'Renewable Energy Model Promotion Plans' aimed at solar thermal energy, photovoltaic and wind power. In 2002 the Executive Yuan announced a 'Renewable Energy Development Scheme' with financial incentive tools including subsidies and supplements[6], which have carried on in one form or another until they were replaced with the passing of the Renewable Energy Development Act in 2009. While in terms of levying tax on energy, within the original version of the 'Promoting Industrial Improvement Act', all energy saving or clean energy installations all possessed regulations on reducing tax; while this aim was continued in the promoting of the 'Industrial Innovation Act' in April 2010, where Article 30 stipulates the setting up of a national development fund to invest in green industries.

While from 2005 Taiwan began picking up the pace in its promotion of renewable energy industries; that year the National Energy Conference reconsidered targets set for renewable energy capacity and began planning the Renewable Energy Development Act, as well as promoting national scale energy S&T plans. In 2007 at the Executive Yuan Industry S&T Strategy Meeting, the government clearly planned the impact of current measures on the renewable energy structure, setting clear targets: by 2010 generated power capacity from renewable energy sources should reach 3.91 GW, or 10.3% of all power generated nationally. By 2015 this figure should have increased to 4.972 GW or 11.2% of total generated capacity; while by 2025 this figure should reach 8.45GW or 14.9% of total generated capacity (Table 3).

In order to achieve the targets set out in this plan, through a public project method, the government has promoted the installing of renewable energy installation systems, while at the same time beginning in 2008[7] the government also began promoting the 'New Energy Industry Flagship Plan'. In April 2009 the Department for Economic Affairs went one step further proposing the 'Green Energy Industry', which concentrates on developing the photovoltaic, LED, wind power, fuel cells, biomass energy, hydrogen energy and energy information and electric cars industries. Moreover beginning in 2010, in cooperation with this new energy related science and technology R&D, the government developed the 'National Energy Plan'; a plan which can be seen as an integration of policy tools for dealing with the multiple factors of GHG reduction, energy efficiency, renewable energy industry and Taiwan's technological competitive wellbeing in the process of promoting the Renewable Energy Development Act. This process in turn helps to change the structure of energy dependency, improve Taiwan's self developed controls, reducing fossil fuel energy and enabling Taiwan to develop a green energy industry with greater technological competitiveness.

Beginning in 2005 at the same time as the National Energy Conference directly set CO_2 reduction targets for various indus-

[6] Including different annual solar energy thermal water systems promotion incentives, photovoltaic demonstration system subsidies (Photovoltaic roofing (2000), 'Photovoltaic electric city' (2004–2006), Photovoltaic energy government agency key demonstration'(2002–204), 'Remote Islands Emergency Defense System Establishment Subsidies' (2005–2006), 'Photovoltaic campus (beginning in 2006), 'Photovoltaic Community', Photovoltaic Demonstration Building, Wind Demonstration System Subsidies, Geothermal Power Demonstration System subsidies, refer to [31,32].

[7] Currently Hualian City Photovoltaic city scheme has already been implemented, along with the Danshui River Two Banks Taiwan Solar City, 2009 Kaoshiung City Olympic Stadium possesses a capacity of 1MWof photovoltaic generated power.

Table 4
A comparison of the results of these four GHG reduction acts.

Results	Legislation			
	Energy Management Act Amendments	Renewable Energy Development Act	GHG Reduction Act Draft	Energy Taxation Act Draft
Promotional strategies (policy)	Energy marker	RE cultivating industry	GHG registration platform	Levying Energy Tax
		Pilot project	Early plan	Part-merger with green taxation
			Low carbon scheme	Reduce distorted subsidies
				Readjust taxes
Changes in energy structure	Energy user and supplier efficiency	Reduce energy dependency	Promote energy user efficiency and methods for saving energy	Reduce energy intensity industry and society
	Energy saving	Energy self efficiency		Save energy
		Reduce CO_2 emissions from burning of fossil fuel		Encourage use of clean energy
Changes in industry structure	Encourage energy saving technology and energy efficient industries	Promote green industries	Encourage energy saving technology	Change energy intensive industry manufacturing processes
			Change industrial processes.	Encourage the development of energy saving technology industries or green service industries
			Reconsider the development of high energy intensive industries	
			Environmental assessment commitment	

Data source: The author.

trial sectors, the GHG Reduction Act was not the only policy being pursued at the time. This conference decided to set up a national GHG reduction promotion office, requiring basic emission level and energy consumption surveys be carried out in various industries. Moreover, a reduction checks mechanism was to be established, along with guidance for industries implementing voluntary reduction plans and a commitment to large scale investments in environmental assessments. These policy targets were reinforced at the 2006 Economic Sustainable Development Conference and 2009 National Energy Conference's 'Low Carbon Garden', as well as within the 2008 Sustainable Energy Policy Framework. Therefore, beginning in 2005 the Ministry for Economic Affairs 2005 allocated funds for specific plans, actively providing guidance to domestic industries in implementing GHG emission level inventories and registering the results, with the aim of seeing 'Reductions of 8% in the Manufacturing Industry's GHG emission intensiveness'. At the same time, the Department for Environmental Protection as early as 2007 had already initiated the 'National GHG Registration Platform'. These initiatives were all vital tools in preparing Taiwan for the promotion of GHG reduction policy and legislation. By the end of February 2010, there were already 240 factories and businesses who had voluntarily reported their inventory data, and these 240 factories and businesses covered 8 large industrial trade unions, in 2005 the total GHG emission level was 166.48 million tons of CO_2 emissions, accounting for 73.02% of the total 204.81 million tons CO_2 emission levels recorded on the departments of industry and energy's national industry [22].

Besides constructing a registration platform, more recently the Department for Environmental Protection has gradually established a voluntary reduction mechanism, attempting to establish a link with the international CDM and develop methods for reducing emission levels including improving efficiency of equipment, manufacturing processes and installations or facilities; fuel switches, updating equipment or using the afforestation method to draw GHG emissions into the atmosphere. From 2004 the Department for Environmental Protection signed agreements with the photovoltaic and semi-conductor industries committing to voluntary reductions in GHG emissions. By the end of January 2009 these measures had already led to an accumulated reduction of more than 33 million tons GHG emission. Meanwhile in 2005 the Ministry of Economic Affairs also signed agreements with 6 major industry trade unions including steel, petroleum, cement, paper-making and manmade fibers and cotton print and dye, along with the photovoltaic semi-conductor industry to implement voluntary GHG reduction plans, and by 2008 these measures had already reduced emissions by five million three hundred and forty thousand tons, which surpassed the original reduction target of 4 million and 20 thousand tons set for the period of 2004–2008 [23]. Moreover, having referred to the international CDM method, the Department for Environmental Protection gradually promoted an early stage of voluntary reductions, with offsetting plans to encourage large industries to develop their use of environmental impact assessments, with commitments to GHG reductions. Currently, these two schemes have already been adapted to examine applications for 6 small scale expansions to already existing Formosa Plastics facilities, along with a plan for building a new Kuokuang Petroleum facility.

At the same time, in terms of developing technology to support reductions in GHG, Article 26 of the Industrial Innovation Act stipulates that Central Industry Authorities are to subsidize enterprises in promoting the development of technologies which support GHG reductions and pollution prevention. While Item 2 Article 30 also stipulates the establishment of a National Development Fund to provide guidance for enterprises in developing industries' GHG reduction capacity, including carbon capture and carbon storage technology. Although the GHG Reduction Act belongs to the Pollution Greenhouse Gas Emission Management Act, however it also works to promote reductions in Taiwan's four major emission sectors including energy, industry, transport and architecture. At the same time it also takes into consideration related industrial innovation and development policies. Therefore, within this overall legislative promotion process, this act is effective in encouraging enterprises to improve energy efficiency and energy saving as well as encouraging the use of energy saving technology within the overall industrial structure. Moreover it not only encourages changes in industrial manufacturing processes in order to reduce GHG emissions, but also encourages the government to reconsider the continued development of high energy intensive industries and respond to demands for commitments to be made to implement environmental assessments (Table 4).

The Energy Tax Act like the GHG Reduction Act was legislated under pressure to bring about reductions in CO_2 emissions. As energy prices rose internationally and pressure for developing green industries increased, the Economic Sustainability Conference held in 2006 discussed these issues in the light of industrial competitiveness, deciding that domestic energy prices in the short term should rationally reflect costs, while in the long term exterior costs should be interiorized, with the best policy tool being seen to be the levying of tax on energy or related green taxation as was already being adopted by countries worldwide. The overall consensus reached at the conference was that before passing the Energy Tax Act, subsidize previously available for fossil fuel energy industries should be cancelled. At the same time, in 2008 the Sustainable Energy Policy Framework reconfirmed the levying of energy tax as a three win strategy simultaneously good for energy, industry and the environment.

It was in such a context that the Energy Tax Act was drafted, planning and implementing a part of this taxation merger, to combine Taiwan's energy related tax tariff measures including commodity tax, customs tax, business tax, vehicle fuel charge, air pollution prevention charge, soil pollution and groundwater pollution remediation charge, oil fund and so on, in order to achieve the aims of reflecting energy use costs, developing a fair taxation system and strengthening economic competitiveness. More importantly, taking into consideration Taiwan's long term dependency on fossil fuels, high energy intensive industries, along with its current transportation and urban situation, the aim of this act was through a levying of energy taxes, to bring about a systems shift in Taiwan's energy intensive society in order to protect the environment, save energy and so on. Some economists (Executive Yuan Economic Construction Committee 2009) have even pointed out that the introduction of energy tax has a second important benefit in changing Taiwan's tax and subsidy allocation, cancelling industrial subsidies which do not make sense in the light of new trends, having in the past been used to reduce taxes and provide subsidies for public transportation, and promoting economic efficiency and improve overall allocation. At the same time, this environment of lower tax burdens can be used to encourage foreign direct investments, and incite the development of newly emerging energy saving industries and new energy technologies, simultaneously achieving the acts third bonus. Therefore, in conclusion, energy policy dealing with the levying of energy tax, industrial policy and S&T development, should give rise to a decrease in the energy intensive nature of industry and society in Taiwan, to enable the government to reach its targets to save energy, encourage use of clean energy and so on. While in terms of this new industry structure, besides encouraging changing energy intensive industrial manufacturing processes, this act also promotes the development of energy saving technology industries pr green service industries. In comparison to the other three acts, the Energy Tax Act works to bring about a carbon reduction result through changing the industrial structure and individual lifestyle consumer habits.

6.2. *Legislative pressure*

By 2010, the process of launching pilot projects for these policies has already developed, and with the gradual passing of amendments to the Energy Management Act and Renewable Energy Development Act, the overall process of constructing these four carbon reduction acts can been seen as having reached its middle phase. However, as a result of socio-economic factors, the GHG Reduction Act and Energy Tax Act remain in need of further promotion. Due to the fact that these first two acts promoted the development of energy saving technology, and encouraged green energy industry, they faced less opposition from key stakeholders, while the latter two acts are more concerned with strengthening management regulations, and besides this different sides possess highly differing perspectives as to how to set targets to implement total GHG emission controls and reduce carbon emission, while at the same time impacting the operation and competitiveness of industries.

6.2.1. *Vertical pressures on legislation*

The vertical pressures facing these four pieces of legislation can be separated into pressure from above in terms of international pressure and pressure from below to push the government to work hard and political economic pressures. For one thing the likelihood of international sanctions being imposed to encourage green trade is a clear and direct pressure. With the increase of energy intensive industries and economic growth over the past 20 years, the amount of CO_2 emissions being released from burning of fossil fuels increased from 109 million tons in 1990 to 255 million tons by 2008. That is to say that Taiwan's CO_2 emissions increased 135% over 18 years that is an annual increase of 4.9%. By 2008 Taiwan's total CO_2 emissions already accounted for 1% of global emissions and Taiwan was ranked as 22nd largest CO_2 emitting country in the world; while in terms of average CO_2 emission level per person Taiwanese came in at 18th, as a result of which Taiwan has already become an important target of international attempts to reduce CO_2 emissions. In direct response to these international green treaties beginning in 1998 the Taiwan government began promoting a number of energy related policies and legislation, in order to strengthen Taiwan's institutional capacity to adhere to these international treaties.

Besides international CO_2 reduction pressure, direct pressure applied from within Taiwan has also been unceasing. The highly dependent nature of Taiwan's energy structure, the dramatic climate change experienced in recent years, the burden placed on the economy and industries, along with the CO_2 target problem of being a non Annex 1 newly industrialized country, all became grass root sources of pressure during the legislative process. For example in response to the issue of Taiwan's dependence on energy intensive industries, policymakers developed policy promoting greater energy diversification and development of clean energy to reduce the high GHG levels emitted by high energy consumption. Taiwan has experienced above average climate change in recent years, over the past one hundred years Taiwan's average temperature has increased by about 2.8 °C, which is about twice as fast as the global average of 1.4 °C. And this dramatic climate change not only obvious in increasingly high temperatures but also in an increasing amount of storms and typhoons threatening lives and property. It was under such accumulated pressure that the government made moves to set new CO_2 reduction targets.

Therefore, the Taiwanese government has made significant effort in promoting various CO_2 reduction legislation, with the hope that through the amendments made to the energy management act, Taiwan may be able to achieve its aims to save energy and ensure energy efficiency; while the Renewable Energy Development Act encourages the development of green energy and reduction in the dependency on fossil fuel energy. Moreover the GHG Reduction Act enables the setting up of total emission controls, opening up the way for establishing voluntary reduction mechanisms in line with international clean development mechanisms, while the Energy Tax Act achieves reductions in the energy intensity of industries and changes the energy consumption levels of both industries and individual lifestyle. Therefore, we can see that the functions and aims of these four acts are designed to be complementary; through the setting up of various legal procedures including efficiency and effectiveness standards, total emission controls, economic incentives, R&D encouragement, administrative checks, and stipulating that permission be needed to construct new buildings or carry out

expansion work on already existing facilities, the government had planned its overall GHG reduction standards. At the same time, by promoting policy-oriented legislation process, the government also developed various administrative incentive strategies, pilot projects cultivating CO_2 reductions in social environment, with the hope of securing the greatest legislative results.

However attempts by the government to promote this legislation have been directly challenged by industrial and economic concerns. According to Taiwan's air pollution prevention charge think-tank and emission level report think-tank, the CO_2 emission level of Taiwan's 300 largest factories have an accumulated total of 289.8 million tons, with high emission industries, namely the power industry, oil refinery and petroleum industry and steel industry account for 30.7%, 25.6% and 8.1% of this figure respectively [30]. As a result from the perspective of the industrial sector, the impact of implementing the GHG Reduction Act and Energy Tax Act will not only conflict with the economic interests of high intensity industries including steel, petroleum, ships, concrete, metals, power and upstream industries.

Besides the backlash from industry groups and civil society, the government has also to deal with the issue of whether or not the CO_2 reduction targets set by the government are acceptable to international standards. In the post-2012 international climate regime there has been a gradual increase in calls for newly industrialized countries to take greater responsibility in CO_2 reduction efforts. Although many researchers point out [2–4,7], that in setting international GHG reduction level targets, there needs to be greater communication between north and south, and a respect for the CO_2 reduction capacity of developing and industrializing countries; however if Taiwan's continually increasing GHG emission levels are anything to go by, demands for stricter reduction targets are going to be difficult to avoid. Despite the Taiwanese government's attempts to deal with these issues by setting new reduction standards (reduce CO_2 emission back to 2005 level by 2020) and promoting carbon trading and CDM mechanisms within the GHG Reduction Act draft, yet it remains uncertain whether or not these reduction targets or the effectiveness of these mechanisms will secure international recognition.

6.3. *The horizontal pressures on legislation*

The effect of administrative controls on climate change and environmental issues passing juridical review has strong implications not only for the legal sector but also for the other aspects of domestic policy and regulations. Since Taiwan has yet to experience a climate change related law suit, the central government environmental policy, the relaxed nature of environmental controls on industry, corresponding political economic pressures, even industry development incentives, all work together to form a horizontal pressure effecting legislation and influencing the progress of the four acts aimed at CO_2 reductions.

International developments in energy saving and green energy industrial incentives have driven Taiwan to promote related energy law. Taiwan's strong semi-conductor industry, along with its strong foundation in mechanical and electrical and LED technology, provide a convenient and competitive advantage in switching to developing energy efficient technology and renewable energy industries (such as solar and wind energy) [31,32]. The revising of the Energy Management Act and formulating of the Renewable Energy Development Act have occurred under the pressure of the international energy development trend and CO_2 treaty industrial incentives.

The constant increase in GHG emissions over the past twenty years along with the lack of energy efficiency are on the one hand the result of a number of factors including the government's active cultivation of key industries, low intensity of environmental controls and administrative agencies loose controls or neglect of pollution issues; while on the other hand the overall uneven nature of the government's industrial policy and the inability of high energy intensive industries' structure to cope with strict CO_2 reduction standards are also important factors. Long term development has formed strong political and economic factors and no matter whether promoting GHG reductions or energy tax, all will face strong lobbying pressure from within industry.

In 2009 the Tax Reform Committee was established under the authorization of the government with a resolution to develop an energy taxation system which reflects the cost of energy, and achieves environmental protection and reallocation aims, gained universal support from specialists and public alike. The current Minister without Portfolio has recommended that if the government adopted the DGEMT model assessment and begun levying energy tax and implementing tax reduction measures by 2018 it would have a notable effect on CO_2 reductions and energy saving targets, and while the social effects of the policy's success could lead to a decrease in economic growth, there would still be net gain of 36.15 billion TWD. However, these important green taxation reforms have all but drawn to a halt under the current economic recession and backlash from industrial and business groups. The Industrial Association strongly advocates that Taiwan's energy tax conditions are not satisfactory, citing international trade competition as its main reason, as well as the effect that such taxation could have on industrial development and export capacity; concerns which affect Taiwan's main manufacturing industries including the textile, petroleum and steel industries. Therefore the Industrial Association recommended the government refer to systems for tax exemption for certain industries which have already been adopted in other countries; currently such policy measures should be aimed at energy saving and encouraging high efficiency energy use. The Industrial Association emphasized that only in the future, if and when conditions are considered to be satisfactory should any energy taxation system be gradually implemented.

However, from another perspective the delayed passing of the Reduction Act and the Energy Tax Act, could increase the pressure on Taiwan to achieve overall CO_2 reduction targets; whereas passing the legislation would demonstrate the determination of the Taiwan government to effectively address this issue, which would help to gain international approval for current targets. It was during the 1998 National Energy Conference that the first targets were set in response to the reduction framework set out in the Kyoto Protocol with the goal of reducing CO_2 emission levels to the 2000 standard by 2020. However, being a newly industrialized country driven by manufacturing and trade, there is a need for Taiwan's international CO_2 reduction responsibilities to be balanced together with the pressure to remain economically competitive. With this in mind, these primary targets were not reiterated during the 2005 National Energy Conference, nor were new clear targets set, a fact which received widespread criticism from environmental protection groups. It was not until 2008 that new reduction target standards were set out in what became the 2008 Sustainable Energy Policy Framework. These second round of targets stated that between 2016 and 2020 emission levels should be reduced to their 2008 levels, while by 2025 levels should be reduced back to Taiwan's 2000 levels (2005 proposal). The third time reduction targets were set was in response to the COP15 Copenhagen Accord; in May 2010 reduction targets were reformulated by the Executive Yuan, with emission levels aiming to be reduced to Taiwan's 2005 levels by 2020 and back to the 2000 levels by 2025 (2010 proposal). At the same time, the government announced its 'Environmental Protection Save the Country' concept in which Taiwan will officially commit to reducing its CO_2 emissions by 30% by 2020.

The fact that CO_2 reduction targets have been set three times demonstrates that the Taiwan government possesses relative flexibility in adjusting its policies. While the latest reduction targets reflect the governments attempts to promote the concept of a low carbon economy and low carbon society. It is only the aspects which could directly affect the industrial lobby, economic capacity and social expectations where the 2010 proposal still needs to continue negotiations between government sectors, industry and civil society, in order to reach a consensus on reduction targets from the bottom up, while simultaneously seeking international approval. At the same time the question of how to practically work this target into the GHG Reduction Act and enable the other three acts to support the reaching of this target is also in need of careful planning. In particular, developing the potential for harmony and mutual support between the four acts, to achieve the most appropriate CO_2 reduction results, and enable Taiwan to cope with its international responsibility for CO_2 reductions and the pressure of potential green trade sanctions.

6.4. Socio-cultural pressure

An increasing public awareness of the risks of climate change and the monitoring of these risks by civil society, are also important factors driving the government to promote the four acts on CO_2 reduction. The work done by Al Gore and IPCC amongst others, along with the dramatic climate change lead to a series of serious disasters which Taiwan has faced domestically have caused this growing public risk awareness to continue and increase.[8] Moreover, beginning in 1998 various sized national energy conferences, sustainable economic development conferences or energy policy framework, all worked together to formulate low energy intensity industrial development, which in turn led to the revising of the Energy Management Act as well as the need for amendments to be made to the Renewable Energy Development Act. However in recent years the government in promoting its industrial policy has controversially continued supporting a number of unsustainable industries, which has made them the target of strong criticism from environmental groups.

Beginning in the mid-2000s, a controversy emerged over the development of Taiwan's heavy industries, which was centered on the petroleum, oil refinery and steel, three high energy intensive industries. Early in 2005 a controversy emerged over the construction of seven new facilities including a light petroleum factory and YeLong Steel Refinery factory, producing 18 and 17 million tons in CO_2 emissions respectively; and this along with the Formosa Plastic's steel refinery factory, Dragon steel factory and three other expansion planned investments, would be the source of an increased 106 million tons of CO_2 emission annually, almost as much as Taiwan's overall CO_2 emission level in 1990.[9] While in 2010 the center of environmental groups and monitors attention was the possible 10.58 million ton increase in CO_2 emissions a year to be caused by the expansion of 6 Formosa Plastics facilities and an increase of 23.67 million tons of CO_2 every year from a Kuokuang Petroleum case.[10]. With Formosa Plastic's six facilities producing a combined 67 million tons of CO_2 emissions[11] added to that produced by the Kuokang facility, the CO_2 emission produced by these two companies would account for a third of all of Taiwan's CO_2 emissions, raising demands from academics and environmental groups to reexamine this controversial industrial policy and return to Taiwan's 2006 resolution to pursue sustainable economic development, with low pollution, low energy intensity industries, while not encouraging the economic development of Taiwan's petroleum industry in order to avoid international trade sanctions in the not to distant future.

These cases challenge the concept of total emission controls set out in the GHG Reduction Act. Although according to Low Reduction Early Action Project promoted by the Department for Environmental Protection, Kuokuang Petroleum had already committed to adopting GHG reduction measures, to decrease emission by half, yet with the overall picture being one of continual increase of CO_2 emissions, the chances of successfully reaching this target are not optimistic. In conclusion, with the government being urged to commit to a low carbon economy, innovative development, green industry and other socio-cultural pressures directly affect the reg-

Table 5
Structure of overall domestic energy consumption (by sector).

	1993	1998	2003	2008
Total amount 10^3 KLOE	61,006	81,076	105,484	117,686
Energy sector own use%	8.9	10.5	9.2	8.7
Industrial%	48.3	46.4	48.6	51.7
Transportation%	17.4	17.6	14.9	13.1
Agriculture%	2.4	1.9	1.5	0.9
Service%	6.0	6.3	10.0	10.1
Residential%	12.2	12.3	11.8	11.2
Non-energy use%	4.8	4.9	3.9	4.3

Data source: BOE [10].

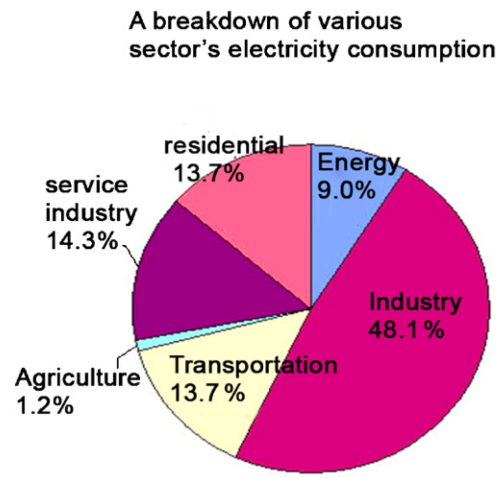


Fig. 10. Taiwan 2008 fossil fuel CO_2 emission sector ratio. *Data source*: The Department of Environmental Protection encouraged Taiwan to join the Climate Change framework [12].

[8] Al <fn0040>Gore, 'Unwilling to face reality' and the local media's reporting on Taiwan's rapid climate change with the temperature crisis ±2 °C, gaining public attention.

[9] Zhang Zi-Jian, Sustainable Economy—not only readjust, but also reform, Taiwan's Economic development meeting, manufacturing industry meeting, Industrial Development Bureau, 2006/7/1 [34]. At the same time, according to reports, key domestic steel industry research organizations and metal industry research development center has already made clear recommendations to the government, stating that incentives should be made available for the steel industry upper stream steel refinery factories and foreign direct investment for building new facilities and move towards industrial promotion and reforms in response to the trend of international controls on GHG emissions. Refer to [35].

[10] DEP GHG management news indicated that the Kuo-kuang case adopts low consumption energy manufacturing process technology, to reduce emission by half to 11 million 87 hundred thousand tons. However, the version of the environmental assessment commitment adopted by this development project was heavily criticized by environmental groups [36].

[11] Taiwan Plastic's six lightweight Petroleum Factories combined output value surpasses 1 trillion two hundred billion TWD accounts for 11.9% of Taiwan's GDP, therefore criticism of their high GHG emissions has given rise to debates over the balance between Taiwan's society economic development and the need to develop a sustainable development economy.

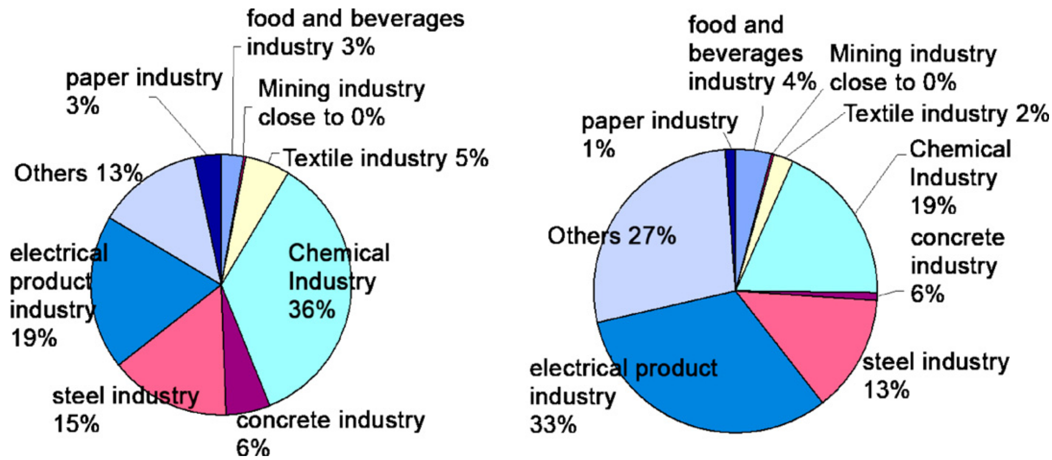


Fig. 11. The emission condition and Production Value of Taiwan's major industries various key industries. *Data source*: The author.

ulated target of the GHG Reduction Act and Energy Tax Act, which is the petroleum, steel and textile industries. Until Taiwan carries out structural reforms on its domestic industrial policy, Taiwan's capacity to economically achieve the GHG reduction targets will remain weak.

6.5. Discussion

Even though these four GHG reduction acts work complementarily and possess important functions in enabling Taiwan to develop a low carbon economy and society, providing useful policy tools and promoting key schemes, yet the current delays facing the passing of the GHG Reduction Act and the Energy Tax Act, not only needs the government's increased vigor in expressing its position and promoting the legislation, but also needs the government to reexamine its industrial policy and adjust the energy consumption industrial structure, in order to gradually strengthen industry's international competitive capacity.

By surveying the current industrial structure, we can see that according to official statistics [37], in 2008 Taiwan's service sector accounted for 73.27% of the GDP, while the industrial sector, only accounted for 25.04%. Demonstrating that Taiwan's industrial structure already possesses a strong capacity for developing its economy through its service industry. At the same time from the perspective of energy consumption ratio, although the industrial sector only accounts for one quarter of the overall GDP, yet it accounts for more than half of all energy consumption (Table 5), producing a clear 'High Energy Consumption, Low Economic Results' slogan.

At the same time, by comparing the output value of Taiwan's heavy industries in relation to the amount of CO_2 emitted by their factories, it is clear that according to an analysis of official statistics, in 2008 Taiwan's service industry was responsible for producing 14.3% (255 million tons) of total CO_2 emissions through the burning of fossil fuels, while profits from the industry sector accounted for only one fourth of total GDP and yet it produced 48% of all CO_2 emissions (Fig. 10). Moreover, of the industrial sector's total CO_2 emission, the chemical industry accounts for 36% (Fig. 11) despite its only accounting for 19% of the industry sector's profits (Fig. 11); the steel industry accounts for 15% of CO_2 emissions but is responsible for only 13% of overall income. These developments show that Taiwan's manufacturing industry is responsible for a comparatively high proportion of CO_2 emissions and yet in terms of actual profit the terms are relatively low.

In fact, in the face of these problems, in 2009 during the National Energy Conference a consensus was reached on the need to adjust the industrial structure, with priority to be given to 'new large scale investments in green industry and non-energy intensive industries'. Therefore since the industrial sector is responsible for a high proportion of all energy consumption and CO_2 emissions, it was decided that an inventory mechanisms should be established, guidance should be provided for upgrading industries and investment and development regulations should be set for industries with high energy consumption, all with a mind limit energy intensive industries' energy consumption and GHG emissions.[12] Moreover, Taiwan's energy and industrial policy are both in need of adjusting, to encourage social resources be fairly allocated in a way that would help in the promoting of the GHG Reduction Act and Energy Tax Act in order to achieve national carbon reduction targets.

7. Conclusion

From these three National Energy Conferences, Sustainable Economic Development Framework and a series of early action promotional policies, we can see that Taiwan, this newly emerging industrialized society, although not officially recognized as an Annex 1 country, Taiwan's government has been relatively proactive though cautious in responding to the challenges set out in the international carbon reduction treaty. While in considering ways to increase energy efficiency, cultivate newly emerging green industry, develop total controls on GHG emission and gradually energy readjust the structure of industries' energy consumption and gradually readjusting the central factors affecting the structure of energy consumption; working in stages to complete the amendments being made to the Energy Management Act and formulating the Renewable Energy Development Act. Moreover, there is a gradual move at the moment to promote the passing of the GHG Reduction Act and Energy Tax Act.

Besides analyzing the legislative intention and framework of these four acts, this research has also indicated the key aims of different stages of this legislative process. While at the same time through a comparison of these four acts, the first steps have been taken in understanding the interaction between these four acts in terms of their controls, procedures and functions, including their regulations concerning energy efficiency and GHG emission effectiveness standard, total emission controls, economic incentives or

[12] This conference took the first steps in setting the 2000 standard emission level as the target for the industrial sector to return to, predicting that by 2015 energy concentration will have been reduced by 10% of the 2000 level; CO_2 emissions will decrease by twenty nine million three hundred and thirty thousand tons; while by 2025 energy concentration will be down by 16% on its 2000 levels, having been decreased by sixty two million four hundred tons, in line with the UN levels. Refer to [15].

subsidies, funds and uses, jurisdiction to perform central checks and calculate statistics, new buildings and expansions, R&D and the spread of technology, all with the aim of moving towards clear standards for the reducing of CO_2 levels. We also pointed out that each act is still in need of further revisions, in order to incite the best legislative results.

While in reality, international green treaties, Taiwan's high dependency on imported energy, dramatic climate changes and the natural disasters they bring and other similar factors, along with the energy consumption industrial structure, economic capacity for handing these changes, the dilemma of environmental controls and civil society's increasing awareness of these issues, all work together to form direct or indirect political economic pressure, which in turn influences current efforts to promote the GHG Reduction Act and Energy Tax Act. Moreover we can learn from the EU's ETS how different development stages have different approaches to planning the overall economy. Within the context of Taiwan's current situation it makes sense to focus on key control targets for reducing GHG reduction levels, beginning with the practitioners in the energy, petroleum and steel industries. One the one hand, the government can adopt various policy strategies both before and after the passing of legislation to encourage and guide industries to use energy saving technology, promote energy efficiency and register emission levels as part of overall controls. This in turn will build an environment which nurtures a mature carbon trade and energy taxation system. On the other, by getting in line with international CDM, referring to various countries and their energy taxation system, it means that when faced with industrial development plans concerned with implementing large scale developments or facility expansions, the energy consumption involved could first be discussed and through voluntary reduction targets and a commitment to implement environmental assessments, a mature offset trade model could be developed.

While most importantly of all, by making a comprehensive survey of Taiwan's industrial development while also facing up to international carbon reduction obligations, this research recommends that under the consensus framework reached during the Sustainable Energy and Economic Conference, the government should reexamine the planning of Taiwan's service economy and energy intensive industries, readjusting the industrial structure and taking advantage of a low carbon economy and society as a potential turning point in economic development. And this in turn means that no matter in terms of international responsibilities, economic and social capacity and potential; gradually strengthen Taiwan's social constitution, with the hope that in the future a three win situation can be achieved between energy, economy and environment. During this process, these four acts will continue to be gradually amended and promoted in response to developments in policy and economic development, completing the construction of Taiwan's GHG reduction legislation and control framework, becoming a vital reference and example for other developing countries or newly emerged industrial countries.

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